On the Insects, COLEOPTEROUS, HYMENOPTEROUS and DIPTEROUS, inhabiting the Galls of certain species of Willow.—Part 2d and last.

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DIPTERA.—Supplement.

GALLMAKERS.—Genus **CECIDOMYIA**, Subgenus **CECIDOMYIA.**

No. 3. Gall S. strobiliscus Walsh.—I described this gall from a single dried specimen found by Mr. Bebb on Salix rostrata in North Illinois. I have since found very numerous specimens of what for the present I regard as the same gall on S. discolor near Rock Island, Ill. Of 23 gathered March 23d one was undistinguishable from the S. rostrata gall; the rest had the tips of the external leaves (except at the tip of the gall) not angulated, but more or less rounded with a subobsolete midrib outside which terminated in a minute tooth or beak. In other respects they did not differ, and especially in the veins on the inside of the leaves being obsolete or subobsolete. The general outline of this gall was ovate lanceolate, rarely ovate; length—rejecting one stunted specimen, which however contained a larva—1.05—1.65 inch, diameter .57—.72 inch. The stunted specimen was not porrect, but deflected at an angle with the axis of the twig, and I subsequently found a few others varying in the same way. In one gall I met with 2 or 3 of the same *Orchelimum* eggs which occur so copiously in *S. strobiloides* O. S., and May 26th I bred several *Orchelimum* larvæ from these galls.

The larva and pupa, as well as the pupal integument, are undistinguishable from those of *S. strobiloides* O. S., but the cocoon is shorter, being only 1½—2 times as long as the larva, instead of 2½—3 times as long: 2 larvæ and 2 pupæ examined April 9.

Imago. Cecidomyia s. strobiliscus n. sp.—Differs from *Cec. s. strobiloides*, Walsh, only in the ♂ antennæ being 23—24-jointed, (not 21—22-jointed,) with 1 or 3 of the terminal joints sessile and the right and left antenna varying in the same ♂ in the number of joints; and in the origin of the anterior branch of the 3rd longitudinal wing-vein being usually pretty distinct. Hence it can scarcely be separated from *Cec. s. rhodoides* Walsh, though the galls are quite different. One ♂, eleven ♀, bred April 30—May 8.

No. 4. Gall S. gnaphalioides Walsh.—I found a single specimen

on a bush of S. discolor growing among numerous S. humilis, on which last willow alone this gall had previously occurred. A very similar gall, but differing in the tips of the leaves not being beaked, was gathered on *S. candida* by Dr. Geo. Vasey, in Illinois. I have 3 dried specimens of it from Mr. Bebb.

No. 5. CECIDOMYIA S. RHODOIDES Walsh.—A ♂ bred in 1865 had 24-jointed antennæ, counted while recent. The other 8 ♂ bred in 1864 had 23—25-jointed antennæ. Within certain limits the number of joints in the Cecidomyidous ♂ antenna seems to be constant, and to differ often in different species.

No. 6. GALL S. CORYLOIDES Walsh.—I have since found two additional specimens in a different locality, and as before on S. discolor. Thus, in addition to the occurrence of two very distinct but closely allied bud-galls on the same species of Willow, S. humilis, viz: *S. rhodoides* and *S. gnaphalioides*, we find two very distinct but closely allied bud-galls on the same species of Willow, S. discolor, viz: *S. strobiliscus* and *S. coryloides*.

No. 7. CECIDOMYIA S. CORNU n. sp.—(The larva only known before.) ♂ ♀. Scarcely differ from *Cec. s. batatas* Walsh, except in the antennæ ♂ being rather shorter and 21-jointed (counted when recent) with the last joint sessile or connate with the preceding, not 18—19 jointed. Two ♂, 3 ♀, bred May 1--9. In the pupal integument the tips of the antennal horns are scarcely, and the thoracic bristles not at all black, while they are conspicuously so in *Cec. s. batatas;* and the larva, as already shown, has a Y-shaped, not as in *Cec. s. batatas*, a clove-shaped breast-bone.

No. 8. GALL S. SILIQUA Walsh.—Besides the single one found on S. discolor, I have since found about a dozen others on that Willow, and received through Mr. Bebb over a dozen gathered on that Willow in New Hampshire by the Rev. W. J. Blake. They can only be distinguished from galls found on S. humilis by their uniformly larger size, which may be due to the rank growth of this species of Willow. Mr. Blake also sent me many specimens of this same gall gathered on S. rostrata in New Hampshire, which were about the same size as those found on S. cordata; and I have a single dried specimen gathered in Illinois on S. petiolaris by Mr. Bebb. Thus we have what seems to be the same gall growing on six different Willows, S. humilis, S. discolor, S. rostrata, S. cordata, (=S. rigida), S. petiolaris, and according to Dr. Fitch on S. lucida. I said (*Proc.* etc. III. p. 592) that the terminal beak of this gall is never recurved in speci-

mens growing on S. humilis; but in 1865 I found one such gall on S. humilis. In those growing on S. rostrata this is particularly common. It is singular that some galls should be thus found on many Willows, and others apparently be restricted to one species; but the same phenomenon occurs in *Cynipidæ*. In one of the public squares in Rock Island, Ill., there grow 30 or 40 trees of the exotic S. alba, and interspersed among them many bushes of the indigenous S. longifolia covered with their peculiar gall, *S. brassicoides* Walsh. Yet not a gall either of that kind or of any other kind, whether Cecidomyidous or Tenthredinidous, can be seen on the S. alba trees, even on the closest examination before and after the fall of the leaf.

Imago. Cecidomyia s. siliqua Walsh.—In 1864 I had bred only ♀ ♀ from galls found on S. humilis. I have since bred 3 ♂ from galls found on S. humilis, 1 ♀ from one of the New Hampshire galls found on S. discolor, and 4 ♂ 5 ♀ from Illinois galls found on S. cordata. They differ in no material respect except sexually; the ♂ ♂ having 20—22-jointed antennæ (counted when recent) constructed as in *C. s. brassicoides* with the last joint sometimes sessile, and a single ♂ having one antenna 21-jointed and the other 22-jointed. Hence, as I surmised, Dr. Fitch must have been mistaken in describing the ♀ [♂] antennæ as 16-jointed. On April 14 I compared a recent ♀ from a S. discolor gall with a recent ♀ from a S. humilis gall, and could see no difference; even the average size of the two insects being the same, though the S. discolor gall averages ½ larger every way. The pupal integuments are also colored in the same remarkable manner, no matter on what species of Willow the galls occur.

No. 9. Gall S. triticoides Walsh.—The larva on April 11 is .09—.10 inch long, about 3 times as long as wide, and fulvous with the usual whitish bowel-like markings. Breast-bone Y-shaped, as in *Cec. s. brassicoides* etc. Head very large, robustly conical, as long and as wide as an average segment is long, so that when it is retracted the anterior end of the body seems squarely truncate. The entire cell, including the beak formed by the bud, is .50 inch long and .05 inch wide, the cocoon nearly the size of the cell, but free throughout and not agglutinated to it. One cocoon extracted whole contained a larva lying with its head a little behind the central point of the cocoon. Two specimens.

No. 12. Gall S. batatas Walsh.—Since 1864 I have found many more of these galls on S. discolor, several of them of the smooth

potato-like type, and bred from them, April 16—21, 33 ♀ without a single ♂ among them, which differ in no wise from ♀ ♀ bred from galls found on S. humilis. I observe that in this species there is an indistinct whitish-cinereous very narrow orbit behind the eye, representing the broader and very conspicuous white orbit found in the inquilinous *Cec. orbitalis* Walsh. From these S. discolor galls I also bred the *Decatoma* reared in such abundance from the S. humilis galls.

No. 13. GALL S. VERRUCA Walsh.—Oct. 11th I found several of these galls on S. discolor, undistinguishable from those found on the closely allied S. humilis. The LARVA was orange-color with the usual whitish bowel-like markings, .08 inch long, 2½—3 times as long as wide, depressed, with a large head. Breast-bone black, elongate-semi-oval and rather longer than wide. Two specimens. Thus we have no less than 4 species of Cecidomyidous galls common to the two closely-allied Willows, S. discolor and S. humilis, viz: S. gnaphalioides, S. siliqua, S. batatas and S. verruca.

No. 14. GALL S. SEMEN Walsh.—This is not a Cecidomyidous, but an Acaridous gall, and is constructed on the same principle as 15 or 16 others with which I have become acquainted, all growing on the upper side for the most part of the leaf of various trees, and composed of a more or less elongate sack opening below by a more or less closed aperture, and on its interior surface covered with rough excrescences of different shapes On the other hand, all Cecidomyidous galls known to me are smooth and free from excrescences inside. From most of these Acaridous galls the mites escape through the aperture below, but in some, e. g. *Cerasi crumena* Walsh MS, on Cerasus serotina, the gall always bursts open above as in *Salicis semen*. Similar, but not identical, galls are found on several other Willows. On Aug. 25 I found in one of these *S. semen* galls, which was about .03 inch in diameter, as many as 40 or 50 hyaline-whitish young *Acarus*, which, as is usual, were much more elongate than the perfect Mite. Hence it may be readily understood how minute their size is, and how liable they are to be overlooked, except under a very powerful lens, especially as, unlike the perfect Mite, they are very dull and sluggish in their motions, which indeed seems to be the universal rule with all the larvæ of the Gall-making Mites. The perfect Mite, which was found on the same day in other galls, is hyaline-whitish with antenniform front legs as long as its other legs, which front legs it elevates in the air and constantly vibrates up and down as it runs. Those found in galls on other trees

differ but little in size, structure or color, some species however being spotted. In a few galls, e. g. *Cratægi vermiculus* Walsh MS, which occurs abundantly both on Cratægus tomentosa and Cr. crus-galli, the larvæ of the mite are of a pale pink color.

No. 15. Gall S. ÆNIGMA Walsh.—I have little doubt that this gall also is a deformation produced by an *Acarus*. From its great scarcity in 1866, I was unable to examine any green specimens, but on Aug. 27 I found among the crumpled exterior surface of a partly dried-up specimen a half-grown *Acarus* similar to those found in *S. semen*. It may be stated that on the tree from which this gall was procured there were no *S. semen* galls; for this gall too, as well as *S. ænigma*, though so exorbitantly abundant in 1864 has been comparatively quite scarce in 1866. Usually in Acaridous galls the larvæ live in a hollow inside; but in one on the leaf-stalk of the Black Walnut —*Juglandis caulis* Walsh MS—they reside among the brown external woolly pubescence, just as in *S. ænigma* they probably reside in the crumpled external surface of that gall. The Cecidomyidous larvæ that I found in June and August in *S. ænigma* were most likely inquilines. (*Proc.* etc. III. pp. 608—9.) I have received through Mr. Bebb from G. W. Clinton, Esq., Buffalo, N. Y., pressed specimens of this gall growing on the same Willow—*S. nigra*—on which I find it exclusively. Hence there are at least 3 Willow-galls common to the Eastern and the Western States—*S. strobiloides*, *S. siliqua*, and *S. ænigma*.

INQUILINES OR GUEST-FLIES.

Genus **CECIDOMYIA**, Subgenus **CECIDOMYIA.**

A. Cecidomyia albovittata Walsh. On May 5 I bred a ♀ from the gall *S. strobiliscus* Walsh found on S. discolor.

D. Cecidomyia orbitalis Walsh. One ♂, one ♀, which may possibly belong to this species, and which must have come out since May 14, were found May 26 dead and dry in a jar containing many of the Tenthredinidous galls *S. gemma* n. sp. They are a little smaller than my smallest *orbitalis*, and the ♂ has 17-jointed, not 18—19-jointed antennæ, with the pedicels on their basal ½ about as long as the globular part of each joint; otherwise, so far as can well be ascertained from the dried specimens, they do not differ materially, though I incline to believe them distinct from the difference in their pedicels.

Genus **CECIDOMYIA**, Subgenus **DIPLOSIS.**

D. Diplosis atrocularis Walsh.—I bred a single ♂ Sept. 27th

from the Cynipidous gall *Q. ficus* Fitch of the same year's growth. From another Cynipidous gall of the last year's growth, *Q. prunus* Walsh, I bred May 26 1 ♂ 1 ♀ of an undescribed *Cecidomyia* about the size of *orbitalis* Walsh. I believe that these two and a third already mentioned by me (*Proc.* etc. III, p. 549) are the only recorded cases of Cecidomyidæ being inquilinous in Cynipidous galls.

G. Diplosis septemmaculata Walsh.—I bred a single ♀ August 23rd from recent Black-knot found on the wild plum. From the Coccidan gall *Vitifoliæ* Fitch (see the *Practical Entomologist* I. pp. 111—2, and II. p. 19.) I bred Aug. 12—20 3 ♂ and very numerous ♀ ♀ of this species. Hence, if I am correct as to the fungoid nature of Black-knot, (see *Practical Entomologist* I. pp. 48—51,) the same Guest Gall-gnat sometimes on the one hand breeds in Cecidomyidous or Coccidan galls, sometimes on the other hand breeds in a fungus, when, properly speaking, it ceases to be a Guest Gall-gnat.

On p. 562 of the first part of the Paper, I called in question certain supposed assertions of Harris and Fitch, as to the larva of *Cecidomyia* transforming gradually into the pupa state, by a kind of budding process, without moulting the larval integument, quoting Harris's book as authority. It now appears that Dr. Fitch's views on this subject must have been misunderstood by Dr. Harris, or else that they have been subsequently modified. For in the 3rd volume of the *N. Y. Reports* (p. 65) all that Dr. Fitch asserts is, that the larval integument in *Cecidomyia* is shuffled off towards the tail of the future pupa, and is there "broken into shreds and flakes which the motions of the pupa cause to separate and drop off," though on the back of the insect "he was unable to detect any exfoliation whatever." Thus nearly the whole peculiarity of the process reduces itself to this, that instead of the larval integument being moulted whole, as with almost all other insects, it is moulted piecemeal. I can readily believe this to be so with the Willow *Cecidomyia*, because I have never detected in their pupal cocoons any complete integument. But in the case of a large undescribed species of *Diplosis* (*D. helianthi-bulla* Walsh MS.,) which makes a globular sessile hollow gall about the size of a large pea on the leaves of Helianthus, I have repeatedly found in the gall along with the pupa a complete larval integument, as large in comparison with the size of the insect as that of any Lepidopterous pupa. In this particular case, therefore, the larval integument cannot be moulted piecemeal.

On p 569 of the same Paper I also showed, that Harris must have been mistaken in supposing, that the larva of the Wheat-midge formed no cocoon when it went underground. Dr. Fitch, on p. 60 of the volume above referred to, explains how he made the interesting discovery, that these larvæ really do inclose themselves in cocoons, agglutinated to the earth just as I had suggested; and that "they do not remain naked in the ground, as he had all along supposed them to." The Wheat-midge, by the way, as is abundantly evident from Harris's and Fitch's descriptions and figures, is a true *Diplosis*, and consequently its correct name is *Diplosis tritici*, Kirby. In consequence partly of the ♂ having been unknown to European authors, it is erroneously referred to the subgenus *Cecidomyia*, instead of to that of *Diplosis*, by all authors known to me, including Osten Sacken. (*Dipt. N. A.* p. 189.) The Hessian Fly, on the contrary, (*C. destructor* Say) really does belong to the subgenus *Cecidomyia*.

The "two small oval lamels" described by Winnertz as attached to the oviduct of a European *Diplosis*, and suspected by me (*Proc.* &c. III. p. 556) to be nothing but two eggs protruding, I have since noticed in several *Diplosis*, when the oviduct is exserted to its utmost length; and they are not eggs but true parts of the oviduct.

HYMENOPTERA.—Family TENTHREDINIDÆ.

For the sake of scientific precision, it may be as well to touch upon a few points relative to the Natural History of this family.

I. Authors originally described the Tenthredinidous abdomen as 9-jointed in both sexes. (Latr. *Gen. Cr. Insect.*, III. p. 225.) Westwood first proved, that what had been previously considered as the 1st abdominal joint was in reality the metathoracic postscutellum, and consequently that the abdomen here was really not 9-jointed but 8-jointed. (*Introd.* II. p. 92.) And it is difficult to see how any one could come to any other conclusion, after examining a *Cimbex*, a *Hylotoma*, a *Lyda*, a *Cephus*, a *Lophyrus*, a *Euura* or a *Nematus*. For in all these genera there is a large surface of membrane between the so-called 1st and 2nd abdominal joints, occupying the whole gaping suture in *Cimbex* and *Hylotoma*, and a more or less transverse triangular space on the dorsum in the other five genera; which membranous space I call everywhere "the basal membrane." And besides, in other genera (*Tenthredo*, *Dolerus*, *Emphytus* etc.) the so-called 1st joint is split along the dorsal line; and it is every where the ventral arc corresponding to this so-called 1st dorsal joint of the abdomen which bears the hind legs, and which must necessarily therefore be metathoracic.

Mr. Norton, although he fully recognizes the fact of the supposed 1st abdominal joint being metathoracic, and calls it in his descriptions sometimes the "basal plates" and sometimes the "basal membrane," yet has assumed the existence of an imaginary 1st abdominal joint, "which is often concealed by the basal plates of the metathorax," so as to make up the full number of 9 abdominal joints.* Any one, however, can readily see that this imaginary 1st joint is not found in nature; and some of Mr. Norton's descriptions, in consequence of this recognition of a nonentity, are difficult to understand. For example, in *Tenthredo* 14-*punctata* Nort. we read "a broad stripe through the middle of 7 basal segments of abdomen, and seven dots [one dot?] on each side near the base of each, black." (*Proc. Ent. Soc. Phil.* I. p. 143.) Is the imaginary 1st abdominal joint included in these "7 basal joints," or is it not? And if it is, does it bear a broad dorsal black stripe and a black dot on each side? The truth of the matter, I suppose, is, that this author has mistaken what I call the "basal membrane" for a rudimental 1st abdominal joint. But as this "basal membrane" is no part of the external horny skeleton, and is always, so far as I have observed, of a homogeneous color, it can scarcely be marked in the manner inferred by the above description; and most probably it is the 7 basal segments in the Westwoodian sense, not the 7 basal segments in the Nortonian sense, that are in reality striped and spotted with black in *Tenthredo* 14-*punctata*. Moreover not only does Mr. Norton somewhat incongruously use the terms "basal plates," and "basal membrane" as synonymous, (*Proc. B. S. N. H.* 1860, pp. 237, 240, 241, 242, 244, 246, 248, 250, 253, &c.,) but he repeatedly describes the true "basal membrane" as a spot on the 1st abdominal joint; (*ibid.* 1861, pp. 159, 160, 161, &c.;) whereas in reality it forms no part whatever of any abdominal joint, but simply connects the metathorax with the abdomen, and like most other connecting membranes is not spotted, but of a uniform color.

* *Proc. Bost. Soc. Nat. Hist.* 1862, p. 117 note, and compare the description of *Allantus dubius, ibid.* 1860 p. 241, where he speaks of "the fifth, seventh, and two apical segments of the abdomen," and that of *Tenthredo semirufus, Proc. Ent. Soc. Phil.* III. p. 12. Strictly speaking, these "basal plates" ought to be called "terminal plates:" for they are placed at the *tip*, not at the *base*, of the metathorax, the anterior end of the mesothoracic scutel being generally in Insects considered as the centre of polarity. But it is better to use an established phrase, even though it be somewhat incorrect, than to create confusion by changing it. Probably the original author of the term considered the "basal plates" as appertaining to the abdomen; and of course, in regard to the abdomen, they are really basal.

This so-called 1st abdominal joint in *Tenthredinidæ* and *Urocerida*e is manifestly homologous with the posterior subsegment of what is generally considered as the metathorax in other Hymenoptera; and Latreille, Audouin and Schaum, believing that it was abdominal, maintained that therefore the two were both of them abdominal and not thoracic, while Westwood rightly, in my opinion, contended that both were thoracic. In a recent Paper (*Proc. B. S. N. H.* 1866, pp. 279—295) Dr. Packard, although he endorses Westwood's theory on this matter, (p. 282.) asserts that during the development of the pupa of *Bombus* from the larva, and before the final moulting of the larval integument "the basal ring of the abdomen is plainly seen to be transferred from the abdomen to the thorax." (p. 282.)* He might as well assert that, during the process of pulling off a fine network glove from the hand of a lady, the fingers are plainly seen to be transferred to the palm of the hand. Because the metathorax of the future pupa is seen, through the transparent integument of the larva, to underlie at this particular time the basal ring of the larval abdomen, it by no means follows that the former originates and is developed from the latter. Dr. Packard himself allows, that at this particular time the head of the future pupa underlies conjointly the head and the 1st thoracic segment of the larva; (p. 280;) yet he fully agrees with Westwood in repudiating the inference drawn therefrom by Dr. Ratzeburg, that the head of the pupa is formed conjointly out of the head and the 1st thoracic segment of the larva. (p. 280, note.) Surely, if such proof is good for nothing in the one case, it ought to be good for nothing in the other case as well. But then, if Dr. Packard had been consistent in his reasoning here, he would have missed what he considers a notable exemplification of Prof. Dana's theory of cephalization. (pp. 282 and 286.) Unfortunately, however, he cannot be consistent with himself, even for a dozen consecutive pages. On page 283 he says, that the moult into the pupa state takes place in what he calls the 3rd stage; on page 295 he says, that it takes place in what he calls the 2nd stage. It evidently takes place in passing from his so-called 1st stage to his so-called 2nd stage; and the 1st stage of what he calls the semi-pupa, (fig. 1, Packard.) is the larva, and the stages 2—4 (figs. 2—4, Packard) are the pupa, in gradually progressive stages of development; and all his voluminous distinctions between the semi-pupa and pupa states, and the dogmatic assertion (p. 286) that "the terms larva, pupa and imago are not absolute terms," are merely darkening coun-

* See also *Proc. etc.* VI. p. 44, where the same doctrines are re-asserted.

sel. He might as well draw three or four pictures of the gradually progressive stages of development of the imago of a moth or a butterfly, after it has emerged from the pupal integument, the wings, &c. being gradually more and more developed in each successive stage, and then dignify these stages with the high-sounding names of the successive stages of the semi-imago. In all those Orders where the pupa is quiescent (Coleoptera, Neuroptera in the Erichsonian sense, Hymenoptera, Lepidoptera and Diptera,) there are two grand and trenchant distinctions between the larva and the pupa: 1st, that the former has not yet moulted the larval integument and the latter has; and 2nd, that—as has been well pointed out by Schaum (*Ann. and Mag. Nat. Hist.*, London, 1863, p. 178, note,)—the former has the mouth and anus externally open, and can consequently both eat and discharge *fæces*, and the latter has the mouth and anus externally closed by the pupal integument, and consequently can neither eat nor discharge *fæces*.* Now, although we cannot apply the second of these two criteria to those Orders which have an active pupa, (Orthoptera, including Pseudoneuroptera, Heteroptera and Homoptera,) because in these the mouth and anus are never closed at all, yet here we may plainly distinguish the pupa state by the homology of the moultings with those of the Orders which have a quiescent pupa. For the pupa state here, is evidently the period intermediate between the penultimate and the ultimate moult, just as it is in the other case; the ultimate moult, however, here, as in the other case, involving the rejection of two integuments, which are generally almost simultaneously rejected, but in Ephemeridæ are rejected at a considerable interval of time. It is singular that, in a Paper professing to treat of the development and morphology of Hymenoptera, this grand fundamental distinction of Dr. Schaum's and others, has not once been even alluded to by Dr. Packard.

* In some of these Orders there is, in addition, a third criterion—which, however, often admits of exceptions—namely, a difference in the legs of the larva and pupa. For example, in Lepidoptera the larval legs when present, which is not universally the case, are free; while the pupal legs are always present, and are usually soldered to the body, except in the leaf-mining genus *Micropteryx*, where they are free. (Stainton's *Entom. Annual*, 1863, figs. 8 and 8*, &c.) On the other hand, in Coleoptera and Hymenoptera the larval legs when present are free, and the pupal legs are always present and usually free, except in certain Brachelytrous Coleoptera and Chalcidian Hymenoptera, where the pupal legs are present, but the pupa is as much "obtected" as that of any moth, as I have myself observed and as was long ago stated by Westwood. (*Introd.* I, pp. 20 and 37; II, pp. 78—9.)

I say nothing here of the manifestly erroneous assertion, made by Dr. Packard, on p. 282, of the Paper above referred to, in regard to Baron Osten Sacken's belief on the subject of this so-called 1st abdominal segment, (where, by the way, the excellent Articles of that author on *Cynipidæ* are quoted as occurring in Vols. II and III of these *Proceedings*, instead of Vols. I, II and IV,) because the Baron is abundantly able to fight his own battles. The whole Paper indeed, like most of Dr. Packard's other writings, is full of sweeping generalizations, which are utterly unsupported by facts, and which greatly detract from the value of his investigations. For example, it is asserted that in the Honey-bee "we find the head larger and the abdomen smaller in proportion than in other insects." (p. 291.) As if *Brachygaster*, and *Crabro*, and *Lyrops*, and *Chalcis*, and *Perilampus*, and many other Hymenopterous genera, to say nothing of the other Orders, had not much smaller abdomens in proportion to the size of their heads than *Apis!* Again, on p. 292, he asserts, that "Neuroptera" [including in his sense of the term Pseudoneuroptera,] "are, as a whole, water insects;" when the fact is, that 1 of the 11 families into which Westwood divides the Order, (*Sialidæ*,) is aquatic in the larva state only; 3 are aquatic in the larva and pupa states only. (viz: *Perlidæ*, *Ephemeridæ* and *Libellulidæ*;) and the remaining 7 are not aquatic at all. And if we accept Dr. Hagen's arrangement, we find 1 family (*Sialidæ*) aquatic in the larva state only; 4 aquatic in the larva and pupa states only, (viz.: *Perlidæ*, *Ephemeridæ*, *Libellulidæ* and *Phryganeidæ*,) and the remaining 5 not aquatic at all. And if with Dr. Packard we add *Thysanura* to the Order, there will be no less than six out of 11 families that are not aquatic in any of their states. Again, on p. 292 he says, that the Bees, and Hymenoptera in general, are not carnivorous in their habits; whereas, whether we consider the number of genera or of species, much more than one half of the whole Order belongs to the parasitic families, *Ichneumonidæ*, *Chalcididæ*, &c. And on the very same page he asserts that Neuroptera, including Pseudoneuroptera, are all of them carnivorous; whereas *Termitidæ* are certainly not so, and, with a few exceptions, perhaps, *Perlidæ* and *Ephemeridæ* and *Phryganeidæ* are all of them vegetable feeders. In the same manner in the *Maine Scientific Report*, (1863, p. 147,) he asserts it to be generally true of all insects, that the ♂ has one abdominal joint more than the ♀, because, forsooth, this is generally though not universally true of Hymenoptera Aculeata. Moreover, in the *Practical Entomologist*, (I, p. 75,) he asserts that in the Crab

and the Lobster, the gills are attached to the legs on the outside of the body, because, I suppose, he had read that this was the case with certain inferior Crustacea. And, on the same page, he asserts that *Ephemeridæ* are among the hugest of insects and lay but few eggs!! And again, on the very same page, he asserts that *small* size is correlated with superiority of grade, apparently because a Bee is smaller than a Butterfly, Prof. Dana having asserted the very reverse, viz: that *large* size is correlated with superiority of grade, apparently because a Lobster is bigger than a Shrimp, and each author seeing only the examples that make in favor of his own hypothesis, and blindly shutting his eyes to those which make against it; the real truth being that size has nothing whatever to do with the matter. Such hasty and sweeping generalizations remind us of the philosopher quoted in one of Macaulay's Reviews, (p. 282, Amer. Ed.,) who inferred from a few examples carelessly collated, that all men with two given or Christian names were necessarily Jacobins and Disorganizers, and all men with a single given name were inevitably, in spite of themselves, Tories and Conservatives. In both cases, we have but to take a large number of examples, in order to show the utter fallaciousness of the so-called laws.

It is singular that, while Latreille described the Tenthredinidous abdomen as 9-jointed, and Westwood as 8-jointed, neither author seems to have perceived that throughout the family, with one remarkable exception, the ♂ venter is not 8-jointed, but 7-jointed. Yet such is the fact, and we have but to open our eyes in order to perceive it. In ♂ *Tenthredo*, *Nematus*, *Trichiosoma*, &c., there are typically 8 dorsal joints to the abdomen, 1—7 each bearing a spiracle on its lateral surface, and 8 being small, and usually so much retracted as to be invisible, more especially in the dried specimen, so that the dorsum is often seemingly 7-jointed. As is almost universally the case in Insects—though *Cynipidæ* form a notable exception—the ventral joints in these groups lie opposite to the corresponding dorsal joints, and we find ventral joints 1—6 lying exactly opposite to dorsal joints 1—6, while opposite the two dorsal joints 7 and 8, or the one joint 7, if 8 as usual be retracted, there lies only the one large terminal ventral joint 7.* On the contrary, in all ♂ *Hylotomides*, although there are the same number of dorsal joints as in the other Tenthredinidous groups,

* This arrangement may be seen most plainly in such species as have the tip of the abdomen differently colored from the rest of it, both above and below, e. g. *Tenthredo* (*Allantus*) *verticalis*, Say.

and similarly arranged, except that the 8th dorsal joint is larger and is scarcely ever retracted, yet there are always 8 complete ventral joints, 1—6, as before, lying opposite to the dorsal joints 1—6, while opposite 7 and 8 there lie, not one but two joints, viz: joint 7, which is nearly as large as those immediately preceding it, and joint 8, which is very much larger and nearly as large as the large terminal or 7th joint in ♂ *Tenthredo*, &c. Evidently the typical number of ventral joints throughout the whole family is 8; but in ♂ *Tenthredo*, &c., joints 7 and 8 are confluent, so as to become apparently one joint.

In all ♀ *Tenthredinidæ* the abdominal dorsum is 8-jointed, 1—7 bearing a spiracle as in ♂, and 8 being rather small, yet very distinct; but, as in all other Terebrantia, the venter has only six complete joints, the ovipositor and its sheaths taking their origin from under the tip of joint 6, so as to obliterate more or less completely the remaining ventral joints, and being laterally fringed by the overlapping part of the dorsal joints 7 and 8. This overlapping part is found ♂ ♀ in every dorsal joint—being generally in *Tenthredinidæ* distinctly separated by an acute angulation from the dorsal surface and bearing the spiracle in joints 1—7—and has been called throughout in my descriptions "the lateral plate." In reality, this part, as I have observed in Pseudoneuroptera, (*Proc.* &c., II. p. 250, &c.,) is homologous with the "pleura" of the thoracic segments. Westwood indeed describes and figures a small piece (7+), laterally attached to the tip of the 6th ventral in ♀ *Trichiosoma*, as a true 7th ventral. (*Introd.* II, p. 94, figs. 12 and 13.) But on the most careful examination I can detect no such piece in ♀ *Cimbex* or any other Tenthredinidous ♀, though in ♀ *Cimbex* there is a hole or excavation in the spot occupied by his piece "7+." In *Uroceridæ*, it is true, there is a very distinct, small, transverse lateral piece corresponding to the Westwoodian "7+," which is no doubt a rudimentary 7th ventral, and is figured but not numbered or lettered by Westwood. (*Ibid.* p. 115, fig. 13.) But in the allied family *Ichneumonidæ* he neither describes nor figures any such piece, nor can I discover any such myself. Here, therefore, it might be inferred that this author would describe the ♀ venter as 6-jointed. No such thing. In this family he obtains the additional 7th ventral in ♀, not at the tip, but at the base of the venter. For in describing and figuring the ♀ venter of the Ichneumonidous genus *Pimpla* as 7-jointed, not 6-jointed, he has been deceived into considering the 1st ventral joint as two joints, because its basal portion is enwrapped by the horny dorsal joint 1, so as to form a short robust peduncle, the whole of which, both

above and below, is of a much more horny consistence than the true ventral joints. And to carry out his error the more plausibly he figures the ventral joints as dislocated from the dorsal joints. (*Introd.* II, p. 138, fig. 8, and p. 139.) Whereas, we have but to recur to Nature to see that his so-called 7th ventral (the true 6th) is not dislocated from, but lies exactly opposite to the 6th dorsal; his so-called 6th ventral (the true 5th) is not dislocated from, but lies exactly opposite to the 5th dorsal; and so on till we come to his so-called 2nd ventral, (the true 1st,) which lies with its tip opposite to the tip of the 1st dorsal, and in *Pimpla* is pretty long, but in such genera as have a moderate or a long pedunele (*Cryptus*, *Ophion*, &c.) is moderate or short. It may be added, that throughout *Ichneumonidæ* precisely as in *Tenthredinidæ*, the dorsal joints 1—7 bear a spiracle ♂ ♀ on their lateral surface.

In one word in *Ichneumonidæ* the ♀ venter is invariably 6-jointed, with its joints corresponding with joints 1—6 of the dorsum, while on the contrary the ♂ venter is invariably 8-jointed, although in many genera the two terminal joints are more or less retracted, or overlapped and concealed by the "lateral plates" of the terminal joints of the dorsum. Hence in species with a very short ovipositor, if we can count the ventral joints we can always distinguish the sex, and if there are more than 6 of them visible the specimen must be ♂. Of course, care must be taken not to count ventral joint 1 as two joints.

I have dwelt at perhaps undue length upon these points, because they are not only in themselves of theoretical importance, but in Descriptive Entomology it is of real practical moment, when it is stated that such and such abdominal joints are colored differently from the rest, to know which particular joints are designated by the describer as being thus colored. What Westwood and Norton consider as part of the metathorax in *Tenthredinidæ*, other writers call the 1st joint of the abdominal dorsum; and what Norton generally calls the 2nd joint of the abdomen Westwood calls the first. For my own part, I agree with Westwood throughout upon this matter. There has been a similar confusion in Pseudoneuroptera, where in *Odonata* and *Ephemeridæ* some authors have described the abdomen as 10-jointed and some as 9-jointed; the truth being, as I have pointed out, (*Proc.* &c. II, pp. 190—1,) that the so-called 1st joint of the 10-jointed abdomen is in these two families really metathoracic. Moreover, in those Ichneumonidous genera that have very short ovipositors, authors have long recognised the difficulty of distinguishing the sexes; and I know of no

way in which this can be so readily and conveniently done, as by ascertaining the number of the ventral joints, viz: ♂ 8, ♀ 6.

II. In Mr. Norton's earlier papers on this family, probably through some clerical or typographical error, he speaks of *three* recurrent nervures, while in reality there are never more than *two* in the Hymenopterous wing. In his latest papers this is silently rectified. (Compare on the one hand *Proc. B. S. N. H.*, 1861, *G. Dosytheus* p. 151, *G. Emphytus* p. 154, *G. Nematus* p. 157. and *G. Selandria* p. 219, with on the other hand *Proc. B. S. N. H.*, 1862, *G. Tenthredo*, p. 116.)

III. The number of legs and prolegs in the Tenthredinidous larva appears to be often inconstant in a given genus. For example, some *Hylotoma* larvæ are 20-footed, some 18-footed; (Westw. *Introd.* II. p. 97;) some *Tenthredo* larvæ are 22-footed, some 20-footed; (*Ibid;*) and Mr. Norton, probably on the authority of Hartig, asserts the same thing of the larva of the allied genus or rather sub-genus *Selandria*. (*Proc. B. S. N. H.*, p. 219.) It has generally been stated that the larva of *Nematus* is always 20-footed; but unless I have been deceived in my *Nematus s. pisum*, n. sp., the larva in this genus is occasionally 18-footed, the anal prolegs being obsolete.

IV. Westwood, Dahlbom and Hartig, as quoted by Norton, divide the larvæ of the genus *Nematus* into three groups, *a*, Solitary, feeding on leaves, *b*, Social, feeding on leaves; *c*, Living in the galls of plants. (*Proc. B. S. N. H.*, 1861, p. 157.) We may now, from the facts first ascertained by myself, sub-divide group *c* as follows:—*c*, Gall-makers, living in galls made by themselves; *d*, Inquilines or guest-flies, living in galls made by other species of *Nematus* or by *Cecidomyia*. As will be hereinafter shown, there are also gall-making *Euura* and inquilinous *Euura*. In *Cynipidæ* there are tolerably well-marked structural characters, which, as a general though not perhaps as a universal rule, separate the Gall-makers from the Inquilines; (*Proc.* &c. II, pp. 477—8;) but I can detect none such either in the Tenthredinidous genera *Nematus* and *Euura* or in the Cecidomyidous sub-genera *Cecidomyia*, *Diplosis* and *Lasioptera*, all five of which contain some species that are gall-makers and some that are guest-flies. It does not follow, however, that a thing does not exist, because at present it has not been discovered. Observe that no Tenthredinidous genus, with the single exception of *Pristophora* (*P. sycophanta*, n. sp.)—a genus which is little more than a subgeneric form of *Nematus*—and no Cecidomyidous sub-genus is ever inquilinous, unless it also contains species that are true gall-makers. Now, if species were primordially created

with their present specific characters and specific habits, and if consequently the Inquilines were never aboriginally Gall-makers, it seems difficult to understand why there should not, for example, be inquilinous *Tenthredo*, *Selandria*, *Dolerus*, *Emphytus*, *Cimbex*, *Lyda*, *Cephus*, *Hylotoma*, &c., &c., as well as inquilinous *Nematus* and inquilinous *Euura*. Or, in Mr. Wallace's caustic language, must we simply "register the facts and wonder," (*Trans. Linn. Soc.* xxv, p. 31,) without attempting to explain or account for them? The advocates of the Creative Theory, have, indeed, a very short and easy method of treatment in such cases as these.—"I am right and you are wrong. Whenever a fact turns up that is apparently inconsistent with my hypothesis, I am not bound to explain it, *because I am in the right*. But whenever a fact turns up that is apparently inconsistent with your hypothesis, you must explain it thoroughly and satisfactorily, under pain of being nonsuited in the Court of Science, *because you are in the wrong*."

V. As a general rule, *Tenthredinidæ* are variable in their coloration, many species most astonishingly so. I may quote as notable examples *Acordulecera dorsalis* as described by Say, and *Nematus s. pomum*, n. sp., as described by myself. On the other hand the allied family *Ichneumonidæ* are generally very constant in their coloration. I have been in the habit here for many years of breeding and preserving large numbers of various species, and I am confident that this will hold good as a general rule, though of course there are certain exceptions. Now, assuming these facts to be as stated—and they are only a special example of what I have called elsewhere the Law of Equable Variability (*Proc.* &c. II, p. 213 and compare III, p. 424, note)—how can we satisfactorily account for them, on the hypothesis of each Tenthredinidous and Ichneumonidous species having been separately created, and not derived from some primordially pre-existing species?

VI. There are often very remarkable sexual differences in the coloration both of *Tenthredinidæ* and of *Ichneumonidæ*. As a general rule, when such differences exist in *Tenthredinidæ*, the ♂ body is much darker-colored than that of ♀. For example, when there are pale eye-orbits in both sexes they are uniformly narrower in the ♂ than in the ♀; again, the ♂ thorax or the ♂ abdomen, or both, will often be black or mostly black, and the ♀ thorax or ♀ abdomen, or both, red, yellow or greenish, or mostly red, yellow or greenish. Contrariwise, the antennæ, when sexual differences exist in their coloration, are generally paler in ♂ than in ♀, being often, especially on the inferior surface,

red or yellow or greenish in ♂, and black or brown-black, or nearly so, except at the extreme tip, in ♀.* On the other hand, in the allied family *Ichneumonidæ*, when sexual distinctions prevail as to the coloration, the ♂ body is almost universally lighter-colored, instead of darker-colored, than that of ♀. For example, it is perpetually the case that the face of the ♂ is white or yellow, and that of the ♀ black, with only the orbits white or yellow; or that the ♂ has long, broad orbits and the ♀ short, narrow ones or none at all. There are certain species, too, where the ♂ scutel is white or yellow, and that of ♀ is but slightly or not at all marked with white or yellow. There are also very numerous species, where the ♂ pectus is white and the ♀ pectus red, or the ♂ pectus and pleura red and only the pectus ♀ red, or the ♂ pectus red and the ♀ pectus black. In many *Cryptus*, again, as in the European *C. sponsor*, the hind tarsi ♂ are mostly pure white and those of ♀ dusky. And almost always, when, as often happens, each successive set of coxæ and trochanters ♂ ♀ is less white or less yellow than the preceding set, (the ground-color of the legs being rufous or black,) the coxæ and trochanters will be more extensively white or yellow, and of a paler hue, in ♂ than in ♀. With regard to the an-

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* I may quote as conspicuous examples of these general rules, besides several undescribed species, *Zaræa inflata*, Norton, (♂ undescribed); *Acordulecera dorsalis* Say, (which is erroneously described by Say as varying equally in both sexes, whereas out of 62 specimens examined by myself the ♂ is always almost entirely black, and the ♀ varies from almost entirely black—4 ♀ out of 22 ♀—to almost entirely yellow); *Hylotoma scutellata* Say, (♂ undescribed); *H. coccinea?* Fabr., (♂ undescribed); *H. calcanea* Say, (♂ undescribed); *H. dulciaria* Say, (♂ undescribed); *Atomacera debilis* ♂, Say=*Atomacera ruficollis* ♀, Norton; *Tenthr.* (*Taxonus*) *dubitata* Norton; *Macrophya bicincta* Norton: *Emphytus apertus* Norton: *Lophyrus abietis* Harris; *Nematus ventricosus* Klug. (=*Selandria ribis* Winchell): and all the *Nematus* and *Euura* hereinafter described ♂ ♀; all from my own collection. Also from descriptions, where one or both sexes are absent in my collection, *Tenthredo* (*Strongylogaster*) *mellosa* Norton; *Tenthr.* (*Strong.*) *abdominalis* Nort.; *Tenthr. semilutea* Nort.; *Macrophya intermedia* Nort.; *Macr. albomaculata* Nort.; *Macr. pluricincta* Nort.; and *Macr.* (*Allantus*) *cestus* Say. The only conspicuous exceptions to these rules that are known to me are *Tenthr.* (*Allantus*) *verticalis* Say, in which species the ♂ abdomen is rather less marked with black than that of ♀, and *Cimbex americana* Leach, if this last be, as Mr. Norton supposes, (*Proc.* &c. I, p. 201,) identical with *C. LaPortei* St. Farg., which latter has the ♂ abdomen mostly red. I rather believe, however, that there are two distinct Phytophagic species here, one feeding on the elm and maturing in June, and another feeding on the willow and maturing late in September, the larvæ otherwise undistinguishable. Unfortunately, however, my specimens of both these two forms all died in the larva state in their cocoons, so that I throw out the above merely as a conjecture.

tennæ a double law seems to prevail here; for on the one hand there are several *Ichneumon* and *Cryptus*, where the flagellum ♂ is black immaculate and the flagellum ♀ is broadly uni-annulate with white or yellow; and on the other hand it is very generally the case, that the ♂ scape is white or yellow beneath, and the ♀ scape black immaculate.*

In one apparently trivial sexual character that is not colorational but structural, the two families, *Tenthredinidæ* and *Ichneumonidæ*, agree universally, so far as I have observed, thus indicating their common origin from a very remote source; and as I do not know that it has been hitherto published, it may as well be stated here. Not only are the ♂ antennæ very generally longer than those of ♀—which is common almost every where in Insects—but they are universally much more compressed or vertically dilated in proportion to their length. So that antennal joint 3, for example, though of the same proportional length with regard to the other antennal joints in both sexes, and therefore absolutely longer in a ♂ than in a ♀ of the same size belonging to the same species, will be perhaps only twice as long as wide in ♂, while in ♀, from the compression or dilatation being proportionally so much less, it will be three or four times as long as wide.—I leave the believers in the Creative Theory to account for all these facts as they best can, or, if they prefer it, to repose calmly and blandly in the bosom of the Shandean Philosophy, viz: that it has pleased God to make everything thus and so, and that is enough for us.

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* There are so many of our N. A. *Ichneumonidæ* undescribed, or described in one sex only, or ♂ ♀ described as distinct species, or described without stating the sex, that I can only give the few following examples of the above rules; but I am sure, from the many hundred species examined by me, most of them undescribed, that these rules are very generally as stated. *Pimpla pedalis* Cresson, (♂ only described); *Pimpla* [*Cryptus*] *conquisitor* Say (=*plurivinctus* Say); *Pimpla* [*Ichneumon*] *inquisitor?* Say, (♀ only described); *Ceratosoma apicalis* Cresson; *Cer. fasciata* Cresson; *Labena* [*Cryptus*] *grallator* Say and Cresson, (=*Mesochorus fuscipennis* Brullé); *Ichneumon morulus* Say, (♂ undescribed by Say, and =*Troqus flavitarsis* Cresson); *Ichn. otiosus* Say, (♀ only described); *Ichn. comes* Cresson, (♂ only described); *Ichn. grandis* Brullé, (♂=*ambiguus* Cresson, ♀=*regnatrix* Cresson); *Ichn. rufiventris* Brullé; *Cryptus crassicornis* ♂ Cresson, (♀ =*robustus* Cresson); *Cryptus sponsor* (England); and *Mesostenus thoracicus* Cresson. The above all from my own collection. Also from descriptions, where one or both sexes are wanting in my collection, *Ichneumon comptus* Say; *Ichn. navus* Say; *Ichn. montanus* Cresson; *Cryptus extrematis* (—*mus?*) Cresson; *Hemiteles incertus* Cresson, (Cuba); *Mesostenus semialbus* Cresson, (Cuba); *Exetastes scutellaris* Cresson; *Anomalon? recurvus* Say; *Peltastes pollinctorius* Say; and *Arotes* [*Acœnitus*] *decorus* Say.

VII. In common with preceding authors, I have described the veins in the Tenthredinidous wing as black, brown-black, &c., without taking any notice of the white "bullæ," which exist upon the veins throughout this family as I have shown them to exist throughout *Ichneumonidæ*.* As is also the case in *Ichneumonidæ*, we find here in each genus peculiar modifications of the typical system of bullæ. For example, in *Hylotoma* the 1st submarginal cross-vein has one bulla much behind the middle; the 2nd submarginal cross-vein has two bullæ, either confluent (*H. scutellata* Say) or separated by a more or less considerable space; (*H. calcanea* Say, *H. dulciaria* Say, *H. coccinea?* Fabr. and *H. McLeayi* Leach;) the 3rd submarginal cross-vein has two bullæ, placed one of them well forwards and the other well backwards, and separated by a wide space; and the 1st recurrent vein has one bulla placed at its extreme anterior end, and so as to extend on to and beyond the vein in front of it, besides the two universal bullæ which I have lettered *F* and *G* in *Ichneumon*—making in all *eight* bullæ. Contrary to the general rule, there are in this genus absolutely no bullæ whatever on the 2nd recurrent vein. The genus *Tenthredo*, (including as sub-genera, in accordance with Hartig's opinion, *Strongylogaster*, *Taxonus*, *Allantus*, *Macrophya*, *Pachyprotasis* and *Selandria*) has the same eight bullæ as *Hylotoma*, except that the bulla on the 1st submarginal cross-vein (*N*, see below, fig. 1) is placed in the middle, instead of much behind the middle, and except also that the two bullæ, located respectively on the 2nd and 3rd submarginal cross-veins, are always widely confluent so as to cover nearly the whole vein; and in addition it possesses a bulla a little behind the middle of the marginal cross-vein (*M*,) and two others, which are quite or nearly confluent, a little before the middle of the 2nd recurrent vein, corresponding to those which I have lettered *C* and *D* in *Ichneumon*—making in all *eleven* bullæ. In the genus *Emphytus*, on the other hand, where the 1st submarginal cross-vein is generically absent, the bulla on that vein is necessarily absent; and as the bullar system is otherwise the same as in *Tenthredo*, this genus has consequently *ten* bullæ. Finally, in the genus *Dolerus* (including *Dosytheus*), as the 2nd submarginal cross-vein is generically absent; the two bullæ found there in *Tenthredo* are necessarily absent; and as the bullar system is otherwise the

* *Proc. etc.* V, pp. 209—215. Since that Paper was written, I have examined numerous European species belonging to many different genera of *Ichneumonidæ*, and ascertained that the bullæ follow precisely the same laws in exotic as in indigenous species.

same as in *Tenthredo*, except that *B* and *B'* are less obviously confluent, there are consequently *nine* bullæ. Thus it will be seen that the number of bullæ in this family differs in different genera from *eleven* to *eight*. In *Ichneumonidæ* it differs in different genera from *seven* to *four*, calling the spots *F* and *G* bullæ, as they evidently are homologous with *A*—*E*.

As is also the case in *Ichneumonidæ*, the bullæ are most distinctly seen in those species which have blackish wings; yet they are perceptible in certain lights in all species, even in those which have perfectly hyaline wings. But in certain genera and subgenera, e. g. *Hylotoma*, *Tenthredo* (*taxonus*), *Tenthredo* (*selandria*), *Dolerus* (= *Dosytheus*) and *Emphytus*, but not in *Cimbex* nor *Tenthredo* (*pachyprotasis*), there exist in species with blackish wings, in addition to the white bullæ, white streaks running in a fixed and definite pattern, from one bulla to another, and always located in certain slender folds between the main veins, which folds are found equally in such genera and subgenera as do not possess these streaks, and also in *Ichneumonidæ*, &c.

The annexed FIGURE 1 shows the whole system of bullæ and bullar streaks—magnified about six diameters—as it is exhibited in the front wing of *Tenthredo* in *Taxonus tacitus* Norton or *Selandria fumipennis* Norton. FIGURE 2, representing the front wing of *Ichneumon*, is repeated here from *Proc. etc.* V, p. 209, the homologous bullæ being lettered alike in both, so that the eye may catch at a glance the homologies of the two systems. Moreover, not only is there a definite system of bullæ in the hind wing, as well as in the front wing, of *Tenthredinidæ*, just as I have stated to be the case in *Ichneumonidæ*, (*Proc.* &c. V, p. 213,) but in those species which possess bullar streaks in the front wing, there is a corresponding system of bullar streaks in the hind wing also, passing through the bullæ and and bifurcating as in the front wing. But to dwell in detail on all these points would be tedious.

Figure 1. Front wing of *Tenthredo*.

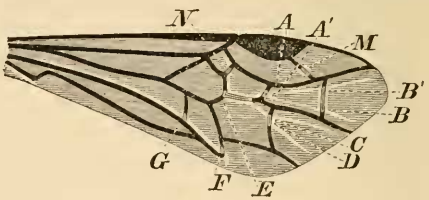
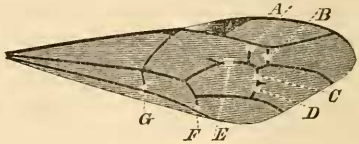


Figure 2. Front wing of *Ichneumon*.



From the above facts it follows, I think, conclusively, that these colorational streaks exist *typically* throughout the whole family of the Sawflies, but that in certain genera and subgenera they are broken up into a series of spots which we call "bullæ," located on the veins and that part of the membrane of the wings which immediately adjoins the veins. Similarly the *typical* black vittæ on the Chrysomelidous elytra are broken up in *Cerotoma camínea* Fabr., *Diabrotica* 12-*punctata* Fabr., *Chrysomela scripta* Fabr., and *Chr. interrupta* Fabr., into several series of short, black, longitudinal lines or spots; and in one and the same species—*Blepharida rhois* Forster—some varieties occur with three uninterrupted vittæ upon each elytrum, while ordinarily these vittæ are broken up into a very variable number of minute dots, and are sometimes almost entirely obsolete. It further seems to follow, that the system of bullæ in *Ichneumonidæ* has been derived from that of *Tenthredinidæ*, by omitting the bullar streaks, even in the darkest-winged species, (except the one passing through *F* and *G*, which in many genera, i. e. *Trogus*. is pretty distinct, and except also a vestige of the submarginal streak in certain species, which I have called a "semi-bulla,")* and by suppressing a few of the bullæ themselves. For example, since both the marginal cross-vein and the 1st submarginal cross-vein are obsolete throughout *Ichneumonidæ*—just as the former is obsolete in the Tenthredinidous genera *Nematus*, *Euura*, &c., and the latter in the Tenthredinidous genus *Emphytus*—the Tenthredinidous bullæ *M* and *N*, which are located on those two cross-veins, are also necessarily obsolete in that family. Again, *A'* is never met with in *Ichneumonidæ*, although in *Pimpla* and *Ephialtes* both *B* and *B'* are found, which I had wrongly supposed to be attributable to the transference of *A* from one cross-vein to another. (*Proc. etc.*, V, p. 211.)

We can now see, likewise, why the bullæ *C* and *D*, which are separated by a wide space in the genus *Ichneumon*, (Fig. 2,) are in the Ichneumonidous genus *Glypta* separated only by a dot and occasionally even confluent, and in the Ichneumonidous genus *Cryptus* are normally confluent. Manifestly it is because the typical white bullar streak bifurcates, in the two first genera, on the basal side of the 2nd recurrent vein a little before it reaches that vein, while in *Cryptus*, as in *Tenthredo*. (Fig. 1, *C D*,) it bifurcates on the vein itself.

Although the locus of the bullæ and of the bullar streaks is always, as I have already stated, in certain slender folds of the wing, yet it is evident that they are not caused mechanically by those folds, as a piece of

* See *Proc. etc.* V. p. 212.

stiffly-gummed black buckram assumes a white streak in the place where it has been frequently folded. For, 1*st*, although there is the same kind of folds in the Ichneumonidous as in the Tenthredinidous wing, yet there are never any complete bullar streaks in that family, except the one passing through *F* and *G*; 2*nd*, as Jurine has remarked, there are very many Hymenoptera that have no bullæ at all, to say nothing of bullar streaks, though they have the same kind of folds to their wings as *Tenthredinidæ*; 3*rd*, even in *Tenthredinidæ* there are certain folds in the wing which are not generally accompanied by a bullar streak, even in those species which have the normal bullar streaks fully developed; e. g. a fold in the 1st discoidal cell, which bears indeed a bullar streak in *Dolerus*, but not in any other Tenthredinous genus known to me, and the fold passing through the bulla *M* which never bears any bullar streak in any genus known to me; 4*th*, in *Eumenidæ* and *Vespidæ*, where the front wing of each individual living wasp is doubled up upon itself and undoubled perhaps a thousand times a day, we generally find no bullar streak in the *locus* where the doubling takes place; and although this fold passes through the bulla *G*, yet it passes through the vein on which *F* is placed, much higher up than *F*, and without causing there the least appearance of any bulla, even in certain dark-winged *Polistes* (*fuscatus*, Fabr. = *pallipes*, St. Farg., *annularis* Linn., and *rubiginosus* St. Farg.,) which possess a pale streak in the place where the folding takes place, and also a regular system of bullæ and bullar streaks.—Westwood, by the way, has inadvertently asserted "that we look in vain throughout the whole Order Hymenoptera, for any other instance" of the wings being doubled upon themselves, as they are well known to be in Diplopterygа. (*Introd.* II, p. 238.) They are doubled upon themselves precisely in the same manner in the Chalcidian genus *Leucospis*, and he had himself previously adverted to the fact. (*Ibid.* p. 164.) And in *Leucospis* (*affinis* Say, 4 specimens,) we do meet with a pale streak, in the *locus* where the folding takes place, though from the defective neuration of the wing there is no visible bullar system.

It does not follow, therefore, because the *locus* of the bullæ and of the bullar streaks is in certain folds of the Tenthredinidous wing, that consequently the folds cause the streaks and the bullæ. Because in the typical Tenthredinide there is a pale vitta, the *locus* of which is immediately under the humeral suture, and because in the typical Ichneumonide there is, in addition, another pale vitta, the *locus* of which is immediately above the humeral suture, it by no means follows that

the humeral suture causes these vittæ. Again, because in the typical *Gomphus* (Pseudoneuroptera) there is a pale vitta, the *locus* of which is on the dorsal carina of what is called the dorsum of the thorax, it does not at all follow that the dorsal carina causes this vitta. Lastly, because in the front wing of *Noctuidæ* the *locus* of the "orbicular spot" is in the wing-cell above the main stem of the median vein, it would be poor logic to infer that that wing-cell throughout this Lepidopterous family causes the spot.

It might, as I formerly suggested, (*Proc. etc.* V, p. 213,) be assumed, that the paleness of the bullæ and of the bullar streaks is caused by a mere structural thinning out of the wing at these particular points. But an attentive examination of many hundred wings under a high power has satisfied me, so far as one can be satisfied without actually measuring and weighing, that the wing-vein is as thick at the point where the bulla occurs as elsewhere, and that consequently this phenomenon is colorational and not structural, except so far as all color may be caused by difference in the microscopic texture of the surface of the parts.

"When I discovered these bullæ," says Jurine, the first author who gave any account of them in print, though he entirely overlooked the bullæ *F* and *G*, "I presumed that they were apertures through which the air contained in the tracheæ [wing-veins] was forced between the double membrane composing the general surface of the wing. But upon examining them with more attention, and upon reflecting that a great number of Hymenoptera were deprived of them, I abandoned that idea, and considered them as a dilatation of the corneous substance of the tubes, caused by the folds of the wing; (*déterminé par les plis de l'aile;*) and in fact it is always in the direction of these folds that the bullæ are found."*

* *Nouvelle Méthode*, &c., I, *Introd.* p. 19. I am indebted to Mr. Cresson for calling my attention to this passage in Jurine. The genera especially referred to by this writer, as having an obvious system of bullæ, are *Nomada* and *Andrena*. The bullæ are tolerably plain also in *Cerceris*, *Philanthus*, *Astata*, *Sphex*, *Priononyx*, *Zethus*, *Augochlora*, *Epcolus* and *Macrocera*, and in many other Aculeate genera there are more or less plain vestiges of them. It is singular that Jurine in his text states that the number of bullæ in Hymenoptera varies from *one* to *seven*, (exclusive of course of *F* and *G* which he had entirely overlooked,) while in the figure which he gives he correctly represents the bullæ on the submarginal cross-veins and recurrent veins of *Andrena* and *Nomada* as *eight* in number. (Plate V, case 15.) He is incorrect in asserting that the continuity of the exterior tube of the vein is interrupted at the point where the bulla occurs. The transverse striations on the exterior of the vein may be distinctly traced under a high power throughout the bulla.

It has been shown, I think, that the bullæ cannot be caused by the folds of the wing, as Jurine imagined, in any other sense than that in which the teeth of a Mammal may be said to be caused by the gums. Neither can we accept the other hypothesis broached by this author, namely, that the bullæ are connected with the respiratory system, because the wing-veins are now generally supposed to be, not tracheæ or air-conducting tubes, as he imagined, but true veins or blood-conducting tubes. But may it not be possible that the bullæ and the bullar streaks are connected with the circulatory system? Until microscopists are agreed on first principles, it is difficult to answer this question satisfactorily. On the one hand, Bowerbank and others, according to Westwood, have proved "the circulation of a cold, transparent, and nearly colorless fluid, not only in the larvæ of *Ephemera*, &c., but also *in the veins of the wings* of the perfect *Hemerobius*." (*Introd.* I, pp. 11 and 15.) On the other hand, according to our distinguished American microscopist, Prof. H. J. Clark, the blood, as seems to be inferred from his language, circulates in the wings of insects, not through what are usually called the veins, but through channels which have no determinate walls. "A careful examination," says this last author, "of some of the more transparent insects, such as the May-fly, (*Ephemera*,) Gall-fly, (*Cynips*,) Plant-louse, (*Aphis*,) Lace-winged Fly, (*Chrysopa*,) Dragon-fly, (*Æschna*, *Agrion*, *Libellula*,) and the grub or worm of many more, has convinced me that, notwithstanding *the apparent lack of walls to the channels of circulation*, the course of the blood is none the less definite; always passing in one set of channels going from the heart, and returning toward it in another set. This is particularly noticeable in the head, legs and *wings*." (*Mind in Nature*, p. 224.) There are three facts, however, which induce me to think, that the bullar streaks cannot perform the same function as the veins in Vertebrata, i. e. reconducting to the heart the blood distributed by the arteries, on the assumption that the wing-veins act as arteries, or *vice versa*. 1*st*. As may be seen in Fig. 1, they cross the wing veins in all directions. 2*nd*. As is also shown in Fig. 1, and as any one may easily satisfy himself to be really the case, by inspecting the natural wing, instead of the branching bullar streaks thickening as they unite with each other and approach the heart, they positively become slenderer, and sometimes even become subobsolete, as they approach either the costa or the base of the wing. 3*rd*. In the genus *Dolerus* (= *Dosytheus*) in 27 specimens of 8 species that I have examined, all of them with distinct bullar streaks, (including *sericeus* Say,

unicolor? Beauv., *collaris* Say, *arvensis* Say, *bicolor* Beauv., *similis* Nort., and two others,) the anterior branch of the submarginal bullar streak, instead of uniting with the posterior branch, as in Fig. 1, *A A'*, fades out suddenly in the blackish or subhyaline membrane, which replaces in this genus the 2nd submarginal cross-vein *A A'*, so as to form no connection whatever with the other branch; though in a few specimens there is seen in certain lights an indistinct fold adumbrating the obsolete cross-vein, which fold, however, is not colored white like the streaks. Surely, if this anterior branch were a true vein or artery, it would form such a connection. What is very remarkable, though *Dosytheus apricus* Nort. (= *D. aprilis* Nort.) has wings no more hyaline than those of *similis* Nort. and *sericeus* Say, which exhibit distinct bullar streaks, in all my eight specimens of this species there are no bullar streaks whatever perceptible, though the folds in the wing are as distinct as usual.

Without venturing the assertion, that the bullæ and the bullar streaks have nothing whatever to do with the circulatory system in the wings, it becomes, I think, sufficiently evident that they cannot perform the function of the veins in Vertebrata, the so-called wing-veins acting as arteries, or *vice versa*. More than this, in the present state of our knowledge upon this subject, it would be unsafe to assert. But even assuming that they form some of the definite channels for the circulatory system, spoken of by Prof. Clark as being without any apparent walls, yet this is quite a different fact from their being colorationally distinguished from the rest of the wing. If the bullar streaks form such channels, it is reasonable to infer that similar channels exist in all Hymenopterous genera, which have visible bullæ but no bullar streaks, and again, in all Hymenopterous genera which have neither visible bullæ nor visible bullar streaks. Their supposed function as blood-conducting channels without determinate walls, is a structural fact; their being sometimes colored in a peculiar manner is a colorational fact; and the two facts, as is abundantly shown by the phenomena exhibited in the Hymenopterous wing, have no necessary connection with each other. Hence, whatever views we may adopt as to the the circulatory system in the Hymenopterous wing, the peculiar coloration of both the bullæ and the bullar streaks, in such species of certain genera and subgenera as have blackish wings, (Fig. 1,) and even in a few species (*Dolerus sericeus* Say and *D. similis* Norton) which have wings that are almost hyaline, the peculiar coloration of the bullæ alone in other genera, (Fig. 2,) and the total absence of any such

coloration in another large group of genera, will always remain as a curious example of what I have called Unity of Coloration. As in other such cases, there exists here a definite Colorational Pattern, distinctly traceable through large groups of species, while in other large groups this Pattern is more or less subobsolete, and in still other groups the Pattern is entirely obsolete.

The Tenthredinidous Willow-galls that are known to me may be thus tabulated, so as to form the complement of the Synopsis of Cecidomyidous Willow-galls given in the former part of this Paper. (*Proc.* &c. III, pp. 575—6.)

SYNOPSIS OF THE TENTHREDINIDOUS GALLS OF THE GENUS SALIX (WILLOW.)

A. Gall always monothalamous, and evidently a deformation of a bud.

III. Bud simply enlarged; its leaves obliterated. } 16, **S. gemma**, n. sp. on S. humilis.

B. Gall a deformation, and swelling of the bud itself.

4. Gall monothalamous, spongy, growing from the side of the twig. } 17, **S. ovum**, n. sp. on S. cordata. / 18, **S. ovulum**, n. sp. on S. humilis.

5. Gall a mere enlargement of the twig, polythalamous, pithy inside, with its cells all internal. } 19, **S. nodus**, n. sp. on S. longifolia.

C. Gall growing out of the leaf, the shape and structure of the leaf still plainly perceptible, monothalamous.

† Quite large, and never, except very rarely, confluent one with another.

3. Spherical or short-oval, sessile. } 20, **S. pomum**, n. sp. on S. cordata and S. discolor.

4. Semicircular in outline, sessile. } 21, **S. desmodioides**, n. sp. on S. humilis.

5. Spherical, with a very short peduncle. } 21*bis*. **S. pisum**, n. sp. on S. discolor.

D. Not represented.

Genus **EUURA**.

This genus differs from *Nematus* in having only 3, not 4, submarginal cells, the one which is 3rd in *Nematus* being obsolete. Specimens of *Nematus* are occasionally found with one of the two front wings like those of *Euura*; e. g. 2 out of 10 *N. s. desmodioides*, n. sp., 1 out of 4 *N. s. pisum*, n. sp., and 4 out of 72 *N. s. pomum*, n. sp. In a bred ♂ of *Nematus ventricosus* Klug, (= *Selandria ribis* Winchell,) *both* wings have only 3 submarginal cells, so that if captured at large the specimen would naturally be referred to *Euura*. In *Tenthredo*, *Allantus*, *Selandria*, &c., I notice many similar anomalies, proving

that the genera *Emphytus* and *Dolerus* cannot be separated from the former by any impassible barrier. Systematists are by no means pleased with such cases as these, because they undermine the foundations of their theories; and such writers as are scientifically dishonest, often wilfully ignore and conceal them. But they are especially interesting to the philosophic naturalist, as showing how one genus gradually passes into another, and how genera have no real ever-permanent existence in nature, but are mere contingent eventualities, dependent upon the circumstance of whether a certain number of intermediate specific forms have perished or not from off the face of the earth, or have escaped or not the researches of collectors. "The Coleopterous genus Brachys," says LeConte, "forms several distinct groups, which I should consider as genera, but that Lacordaire states that they merge imperceptibly together." (*Trans. Ann. Phil. Soc.* XI, p. 251.) On similar principles the very extensive old Geodephagous genera *Agonum*, *Platynus* and *Anchomenus*, and the almost equally extensive old Hydradephagous genera *Hydroporus* and *Hygrotus*, have been amalgamated; while, on the other hand, small genera, containing only a few species, are every day being cut up into new genera, each containing only one or two species, thus making the rich richer and the poor poorer still. In Lepidoptera, according to the Rev. Mr. Green, there is a biennial revolution in England in generic nomenclature; and in Hemiptera Amyot and Serville expressly avow it as their plan, whenever they can establish any difference whatever between two species sufficient for a generic subdivision, to found new genera wherein to place each differing species. (*Hemipt. Introd.* pp, vi—vii.) Where are now the old Linnæan genera? Scarcely a single one remains in the old Linnæan acceptation —all have been cut up into small fragments, and are being daily split up still finer, then, perhaps, re-united, and then once more split up into minute fragments; while the Linnæan species—with a few exceptions, due to misinformation or error on the part of the great founder of Natural History—stand like a rock, and will stand for indefinite ages. And yet we are gravely told, that genera have as real an existence in nature as species!

The genus *Euura* (*anglice* "well-tailed") takes its name from the unusual length of the anal styles or "cerci;" (Westw. *Introd.* II, p. 93, note;) but this character occurs only in the ♀, the ♂ ♂ of both *Euura* and *Nematus* having very minute cerci. Why unusual length of ♀ cerci should be invariably, so far as I am aware, correlated in

this genus with the obsolescence of the 3rd submarginal cell ♂ ♀, is as inexplicable a thing as why blue eyes in the domestic cat should be invariably correlated with deafness. (Darwin, *Orig. Spec.* p. 18.) Judging from what Brullé says, (*Hymen*, p. 666,) *Pteronus* Jurine must be synonymous with *Euura* Newman; although Westwood (*Synops.* p. 54.) gives *Pteronus* Jur. as the synonym of *Lophyrus* Latr., which last has multiarticulate, not 9-jointed antennæ, and also of *Cladius* Leach, which has ♂ antennæ pectinated. But be this as it may, it is always better to retain a name that is in general use, than to rake up an old name that was used by our grandfathers. "The naturalist," says Dr. P. P. Carpenter, "is not necessarily an archæologist."

Genus **EUURA**.—Gall-makers.

No. 16. **Gall Salicis gemma**, n. sp.—On Salix humilis. The lateral bud of a twig, enlarged so as to be twice or thrice as long wide and thick as the natural bud before it begins to expand in the spring, its external surface otherwise entirely unchanged both in texture and color. Internally, instead of the normal downy embryo leaves, it contains early in the autumn a homogeneous, grass-green, fleshy matter, which is afterwards gradually consumed by the larva, leaving nothing at last but a mere shell, as thin as paper, and partly filled with excrement. Sometimes, from the egg failing to hatch out, this green fleshy matter remains unaltered till the spring. The gall is monothalamous, sometimes one only on a twig, sometimes two or three or more at irregular intervals, very rarely as many as 3 or 4 formed out of 3 or 4 consecutive buds. Common and not local. Described from 34 specimens. Length .17—.36 inch; breadth .10—.17 inch. Analogous to the Cecidomyidous gall *S. cornu* Walsh, but very different in its general appearance and in its internal structure.

Larva. The larva is 20-footed, and on Oct. 2 is .13—.19 inch long, of a greenish-white color, the head tinged with dusky, and with the usual fuscous eye-spots. Mouth dusky. At this date a few galls were already bored, and the other larvæ not long after this bored out, and retired an inch or so underground, where they spin a thin, whitish, silken cocoon, to which many particles of earth adhere externally. Two specimens.

Pupa unknown.

Imago. Euura s. gemma, n. sp.—♀ Shining black. *Head* pale luteous: eyes, a square spot enclosing the ocelli, and separated by a moderately wide orbit from the eyes, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 90°. Palpi fuscous at tip. Occiput clouded in the middle with black. Labrum rounded at tip. Antennæ black, except their extreme tips below which are dull rufous, three-fifths as long as the body, joints 3—5 subequal, 4 slightly the longest, 5—9 very slowly shorter and shorter. *Thorax* with the tegulæ and the upper and hind edge of the collare, and also the cenchri, all pale luteous. *Abdomen* with the basal membrane whitish; ventral joints 5 and 6 luteous, but the lateral plates black, so that the tip of the venter seems at first sight black. Sheaths of the ovipositor black. *Legs* pale luteous; tarsal tips, especially in the hind legs, obfuscated. *Wings* hyaline; veins black;

stigma fuscous, dull luteous basally and behind. Length ♀ .12 inch; front wing ♀ .13 inch.

♂ Differs from ♀ only as follows:—1*st*. The spot enclosing the ocelli is larger and separated from the eyes only by a very narrow orbit; and the occiput is distinctly black, except the orbits. 2*nd*. The flagellum is dull rufous above on the terminal ½ and entirely bright rufo-luteous below. 3*rd*. The antennæ are ⅔ (not 3-5ths) as long as the body. 4*th*. The entire tip of the venter is luteous, the lateral plates not concealing its tip in this sex. Length ♂ .12 inch, front wing ♂ .13 inch.

One ♂, one ♀. The ♂ came out May 5, the ♀ May 20. Differs from *Euura orbitalis* Nort. (the only described N. A. species) by the antennæ not having *in both sexes alike* "the apical half pale beneath," and by the venter not being black immaculate. That species is described as having "a pale luteous spot on the 1st segment of the abdomen," but this probably refers to the basal membrane. *Orbitalis* is said to have been taken on "the willow," the particular species not being mentioned.

No. 17. **Gall s. ovum**, n. sp.—On Salix cordata. An oval or roundish sessile monothalamous swelling, .30—.50 inch long, placed lengthways on the side of small twigs, green wherever it is smooth, but mostly covered with shallow longitudinal cracks and irregular rough scales which are pale opaque brown. Its internal substance fleshy in the summer like that of an apple, but with transverse internal fibres. When ripe in the autumn, filled with reddish-brown spongy matter, with close-set transverse internal fissures at right angles to the axis of the twig. On cutting down to the twig at any time, a longitudinal slit about .20 inch long becomes plainly visible. Particular twigs on badly infested bushes sometimes have one of these galls about on every half inch of their length, and not placed in a regular row, but indiscriminately on any side of the twig. Abundant but local. Described from very numerous specimens.

Larva. By August 30 many larvæ are already .10—.12 inch long, and are then imbedded in the slit at the base of the gall; but in many other galls the larvæ are apparently not yet hatched. At this date the larva is pale-yellowish, with a very pale fuscous head and the usual dark eye-spots. Tips of the mandibles blackish. When removed from the gall it uses its legs freely. On Oct. 2, many larvæ were still in the gall, and many remain there all winter, and finish their transformations without going underground. From other galls the larvæ had bored their way out, and no doubt gone underground, leaving their excrement behind them in the excavated gall. On Feb. 20, a larva (1 specimen) was .22 inch long, very pale dull greenish cinereous, the head darker, with a large, blackish, round spot on the face, and the usual eye-spots. Mandibles blackish. Legs long, but porrect backwards and apparently functionally impotent. Prolegs 14, tuberculiform and very short and flat. Most probably, however, this larva must have been that of some unknown inquilinous species. A similar larva, probably that of the inquilinous *Nem. hospes*, n. sp., was found repeatedly in the spring in the Cecidomyidous gall *S. strobiloides* C. S., from which gall I subsequently bred 1 ♂, 2 ♀ of *N. hospes*, and also a single ♂ of the inquilinous *Euura perturbans*, n. sp. A few galls, as late as March 6, were still solid and un-

bored, showing that in these the egg had failed to hatch out. My 15 imagos all transformed in the gall, the galls having been gathered in March. Described from 7 specimens.

Pupa unknown.

Imago. Euura s. ovum, n. sp.— ♀ Shining honey-yellow. *Head* with the eyes, a square spot enclosing the ocelli, but separated from the eyes by a pretty wide orbit, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 90°. Labrum rounded at tip. Occiput more or less clouded with black on the disk. Antennæ dull rufous above, with their basal ½ black, honey-yellow below, with the scape black, and more or less of the basal ½ of the flagellum dusky, three-fifths as long as the body, joints 3—5 subequal, 4 slightly the longest, 5—8 very slowly shorter and shorter, 9 full as long as 8. *Thorax* with an oblong spot on the anterior lobe of the mesonotum, generally extending from the collare ⅔ of the way to the hind angle of the lobe, rarely covering almost its entire surface, the interior ½ of each lateral lobe and sometimes its entire surface, base and tip of the scutel and rarely its entire surface, anterior disk of the metanotum, and the edges of the basal plate that border on the basal membrane, or rarely the entire surface of the basal plate, all black. Cenchri whitish. A more or less distinct black cloud on the pectus, and another on the posterior disk of the pleura, the former occasionally obsolete. *Abdomen* with that part of the anterior edge of joint 1 that borders the whitish basal membrane, or rarely the basal ½ of joint 1, black. Ovipositor honey-yellow, its sheaths dusky. Cerci full as long as the last tarsal joint of the hind legs, honey-yellow, lightly tipped with dusky. *Legs* honey-yellow, the tarsal claws dusky. *Wings* hyaline; veins black; those on the costa, as well as the basal ½ of the stigma, whitish or yellowish; the rest of the stigma dusky. Length ♀ .17—.22 inch; front wing ♀ .18—.24 inch.

♂ Differs from the normal ♀ only as follows:—1*st*. The ground-color is greenish-white, not honey-yellow. 2*nd*. The black spot enclosing the ocelli is larger, and is separated from the eyes only by a narrow orbit and occasionally touches them for a small space. 3*rd*. The occiput, except the orbit, is distinctly black. 4*th*. In the antennæ the pale colors are more dominant, and verge more or less on greenish-white; and the antennæ are ¾ (not 3-5ths) as long as the body. 5*th*. The thorax is black, except the tegulæ, the superior margin of the collare and the cenchri, which are all greenish-white. 6*th*. The abdomen is black above, greenish-white below, the lateral plates basally black, but terminally clouded with the pale color. Basal membrane white. 7*th*. The legs are greenish-white, sometimes, especially the hind legs, more or less honey-yellow. In the hind legs the base of the coxæ, the extreme tips of the femora and the tarsi are more or less fuscous. 8*th*. The veins on the costa are scarcely whitish, and only the extreme base of the stigma is whitish. Length ♂ .10—.17 inch; front wing ♂ .11—.19 inch.

Ten ♂, five ♀, bred April 16—27. Absolutely undistinguishable by any reliable character from the inquilinous *Euura perturbans* n. sp., n. v. Distinct at once from *E. s. gemma* and from *E. orbitalis* Nort., by the abdomen ♀ being honey-yellow above and below, and by the abdomen ♂ having its lateral plates partly pale, and the venter entirely pale.

No. 18. Gall S. ovulum, n. sp.—On S. humilis. Undistinguishable both internally and externally from *S. ovum* n. sp. But for the fact that the larvæ differ in color, and that, of the five species of willow found near Rock Island, Ill., this type of gall occurs only on S. humilis and S. cordata—two willows which are, according to Mr. Bebb, very distinct—and never, as I have carefully observed, on S. discolor—which is on the same authority, very closely allied to S. humilis, the species on which *S. ovulum* is found—I should not suppose *S. ovulum* to be a distinct (phytophagic) species from *S. ovum*. Possibly, indeed, it may not be so; and to determine doubts it is better to await the discovery of ♂ ♀ imago. Besides the three bushes of S. discolor mentioned above, (*Proc.* III, p. 589,) I have since discovered and examined closely several dozens. This gall was rare in 1864—5 and 1865—6, but common in 1863—4. Not local, but generally distributed. Described from 30 specimens.

Larva. On August 30 I compared 6 larvæ, freshly taken from the gall *S. ovulum*, with 6 freshly taken from the gall *S. ovum;* and while the latter were all decidedly yellowish, the former were all decidedly pale greenish. In other respects they did not differ perceptibly, and both had free use of their legs.

Pupa and Imago unknown.

No. 19. **Gall S. nodus.** n. sp.—On S. longifolia. A mere gradual enlargement of a twig from ¼ more than its normal diameter up to twice its normal diameter, almost always without any abnormal roughness on the external bark, and always not confined to one side only of the twig. General color that of the twig. When cut into, Aug. 28, the interior of each gall is found to be pithy, and to contain 1—3 larvæ in separate cells. Frequently, on a piece of a twig 6 inches long, 2, 3 or 4 of these galls are placed at irregular intervals. No appearance internally of any transverse plates or transverse fibres as in *S. ovum* and *S. ovulum*. Length .75—1.50 inch; diameter .10—.25 inch. Described from 31 affected twigs. Abundant but very local. Very like the Cecidomyidous gall *S. nodulus* on the same willow, (*Proc.* &c. III, p. 600,) but is much larger, is polythalamous instead of monothalamous, and occurs near Rock Island, Ill., in quite a different locality. Analogous willow-galls are made in Europe, not by a *Euura*, but by several small species of *Nematus*. (Westw. *Introd.* II, p. 105.)

Larva. Aug. 28, the larva is 20 footed, of a pale greenish white color, with the mouth dark and the usual dark eye-spots. Length about .15 inch. On April 2, a larva (1 specimen) cut out of a gall gathered in the preceding August, was whitish, with a testaceous head and the usual eye-spots. Hence it appears, that some larvæ, at all events, do not go underground to pass the winter, but undergo their transformations in the gall, and also that the larva does not pupize till the following spring.

Pupa unknown.

Imago. Euura s. nodus, n. sp.—♂ Differs from ♂ *Euura s. ovum* only as follows:—1*st*. The pale color is bright honey-yellow, not greenish-white, through-

out, i. e. both in antennæ, body and legs. *2nd.* The black spot enclosing the ocelli is larger, and is confluent with the eye for its entire length, leaving no orbit between them. *3rd.* The venter (dried) is honey yellow on the terminal 3 or 4 joints, and in the middle only of one or two more. Basal plates black, as in *E. s. gemma.* When recent the venter was noted as being "greenish" and the legs as "pale fulvous." *4th.* The legs (dried) are honey-yellow immaculate, except the extreme tarsal tips. *5th.* The basal ½ of the stigma is whitish, as in *E. s. ovum* ♀. Length ♁ .16—.17 inch; front wing ♁ .17—.18 inch.

Two ♁, ♀ unknown. One ♁ came out April 28, the other May 12. Differs from *E. s. gemma* ♁ and *E. orbitalis* ♁ Nort., by the spot on the vertex being confluent with the eye and by the yellowish ground-color; and from the latter also by the pale venter. The size is also larger than that of *E. s. gemma;* but *E. s. ovum* ♁ varies in size fully as much. Possibly the ♀ may differ more remarkably from the ♀ of those species.

Genus **EUURA**.—Inquilines or Guest-flies.

EUURA PERTURBANS, n. sp.—♀ Differs from the gall-making *E. s. ovum* ♀, only by the dorsum of the abdomen varying from honey-yellow, including the lateral plates, through obfuscated, to deep black with the lateral plates also black. The ♁ does not differ in any respect from *E. s. ovum* ♁. Probably if I had bred more *E. s. ovum* ♀, varieties would have occurred there also with the abdomen obfuscated or black above, just as such varieties occur in my *Nematus s. pomum* ♀, n. sp. There is a similar case of extreme range of colorational variation in *Acordulecera dorsalis* ♀ Say, which has been already referred to in a note. (Above, p. 239.) By way of testing the apparent identity of the two species, I sent a normal ♀ of *E. perturbans*, and a ♀ *E. s. ovum* to Mr. Norton, along with many ♁ ♀ varieties of *Nematus s. pomum*, each specimen numbered, but none of them named. And although, as I fully expected, from the great variability of the ♀, he made two species of *N. s. pomum* ♀, yet he pronounced *E. perturbans* ♀ and *E. s. ovum* ♀ to belong to the same species. I think, under the same circumstances, I should have done the same thing myself. Hence we may see how impossible it often is to define the specific characters of different *Nematus* and *Euura*, from the mere comparison of cabinet specimens of their imagos. I believe Mr. Norton has arrived independently at the same conclusion, judging from what he says to me.

Two ♁, five ♀. One ♁ bred April 7, from the Cecidomyidous gall *S. strobiloides*, O. S.; one ♁, two ♀, bred May 7—22, from the Cecidomyidous gall *S. batatas* Walsh; one ♀, bred May 16, from the Cecidomyidous gall *S. rhodoides* Walsh; all the above from galls of the

preceding year; and two ♀, bred many years ago, in the same season that the gall was produced, so far as I recollect, from an undescribed Cecidomyidous bud-gall— *Vitis fusus* Walsh, MS.—composed of bunches of 6—50 fusiform galls growing on the stem of the wild grape-vine, Vitis cordifolia, each gall attached by a single point, and about ½ an inch long.

Genus **NEMATUS.**—Gall-makers.

No. 20. **Gall S. pomum.** n. sp.—On S. cordata, (and very rarely on S. discolor.) A smooth, fleshy, sessile, globular or slightly oval, monothalamous gall, resembling a miniature apple, .30—.55 inch in diameter, growing on one side of the midrib of a leaf, and extending to its edge or sometimes a little beyond it. The principal part of the gall generally projects from the under side of the leaf, and only about 1-6th of its volume from the upper side, although very rarely it is almost equally bisected by the plane of the leaf. Scarcely ever more than one gall on a leaf, and very rarely two of them more or less confluent, so as to seem like one kidney-shaped gall. External color greenish-yellow, generally with a rosy cheek like an apple, especially on the upper surface, and often with many dark little dots on its surface. Internal color whitish. The above is the appearance presented July 31 when the gall is fully matured, but as early as May 24 it has nearly attained its full size, and has the rosy cheek very conspicuous. Abundant but rather local. Described from very numerous specimens. As to the occasional occurrence of this gall on S. discolor see under No. 21 *bis*. An analogous gall is formed in Europe on the leaves of various kinds of willows by *Nematus gallicola* Westw.

Larva. May 24 the larva is only about .10 inch long. On June 11 it is white, .10—.13 inch long. On July 24 it is .15 inch long. On July 30—31 it is .15—.20 inch long, of a pale greenish-white color, the head pale brown, with the usual eye-spots blackish and distinct. Legs freely moveable; 12 abdominal prolegs on joints 5—10 and 2 anal prolegs on joint 12. On Sept. 9, I noticed in a jar containing several hundred of these galls, three larvæ crawling about which were .35—.40 inch long, of a pale cinereous color, with some pale dusky markings and the usual dusky eye-spots. Their legs were freely moveable. Most probably, judging from their size, these last appertained to the inquilinous *N. mendicus*, n. sp., one specimen of which I bred the following spring from the same lot of galls. Of the very large number of the gall-making *N. s. pomum* bred therefrom the same spring, almost all spun up inside their galls, and only a few between and among them, there being no earth in this jar under which they could have retired if they had been so minded.

Pupa unknown.

Imago. Nematus s. pomum. n. sp.—♀ Shining honey-yellow. *Head* with the eyes, a quadrate spot sometimes barely enclosing the ocelli, sometimes almost reaching the antennæ, but even then always separated from the eyes by a tolerably wide orbit, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 90°. Labrum rounded at tip. Occiput always with a capillary black line located in the usual lateral stria, and slowly converging from each posterior ocellus to the disk, where it meets a transverse capillary black line, so as to enclose a trapezoidal space, which is rarely occupied by a black cloud. Antennæ ½ as long as the body, joints 3—5 subequal, 6—8 slowly shorter and shorter, 9 generally as long as 8, the scape black, the flagellum

brown-black, its terminal ½ beneath often tinged with rufous. *Thorax* always with an obscure subquadrate spot where the mesonotal grooves decussate, and a more definite elongate one on the anterior ½ of the anterior lobe, the two often confluent, the tip of the scutel sometimes, and always the entire metanotum including the basal plates, all black. Very rarely the entire mesonotum is black. Cenchri whitish. Pectus immaculate, except in one dark ♀ where it is slightly obfuscated. Dorsum of the *abdomen* sometimes with only the basal edge of joint 1, black, and all the sutures toward the base, dusky; usually with more or less of its basal ½ black; rarely with its whole or nearly with its whole surface blackish or black. Lateral plates honey-yellow, very rarely (1 ♀) basally black. Venter always immaculate. Ovipositor honey-yellow, its sheaths black. Basal membrane whitish. *Legs* honey-yellow, the four front legs with their coxæ and trochanters generally more or less whitish; tips of all six tarsi, especially the hind ones, lightly obfuscated, as are also sometimes the extreme tips of the hind tibiæ. *Wings* hyaline; veins black, the costa honey-yellow; stigma basally honey-yellow, terminally fuscous. Third submarginal cell usually longer than wide, sometimes square, very rarely and only in a single wing 3 or 4 times wider than long or entirely obsolete. Length ♀ .12—.22 inch; front wing ♀ .14—.25 inch.

♂ Differs from normal ♀ only as follows:—1*st*. The quadrate spot on the vertex is larger, often confluent with the eyes either throughout its length or in a single point, and never separated from them but by a capillary orbit. 2*nd*. The occiput, except a very narrow orbit, is decidedly black. 3*rd*. The antennæ are ⅔ (not ½) as long as the body, almost invariably dull rufous above, except towards the base, and bright rufous or pale dull green beneath, except towards the base, very rarely (1 ♂) colored as in ♀. 4*th*. The entire thorax is black, except the tegulæ and an elongate-triangular line on the superior margin of the collare, which are honey-yellow, and the cenchri which are whitish. 5*th*. The dorsum of the abdomen is black, 2 or 3 of the terminal joints sometimes, and occasionally joint 1 or joints 1 and 5 also, lightly tipped with yellow, the lateral plates honey-yellow clouded with dusky, especially towards the base. Venter immaculate. 6*th*. The costa is scarcely pale, and only the extreme base of the stigma is whitish. Length ♂ .17—.20 inch: front wing ♂ .18—.20 inch.

Twenty-six ♂, forty-six ♀, bred April 16—25. A single ♀ bred many years ago, and according to the label from this gall, differs from all the other ♀ in the thorax being as black as in ♂. Distinct from *longicornis* Say, which is described by Say, without any reference whatever to sex, though Mr. Norton quotes him as describing the ♀ exclusively, (*Proc. B. S. N. H.* 1861, p. 158,) by neither sex ever having "two black spots beneath the wings," and by the antennæ being rather short than long. From *nigritus* ♂ Nort., *fulvipes* ♂ Nort., *pallicornis* ♀ Nort., *proximatus* ♀ Nort., *obscurus* ♀ Nort., *luteotergus* ♂ Nort., *erythrogaster* ♀ Nort., *Marylandicus* ♂ Nort., and *subalbatus* ♀ Nort., (which last seems to belong to the genus *Messa*,) distinct by the pale face ♂ ♀ and many other characters; and from *brunneus* ♀ Nort. by the body ♀ being always more or less marked with black. The other described N. A. species, so far as known to me, are entirely different.

No. 21. **Gall S. desmodioides**, n. sp.—On S. humilis. A smooth, flattish, fleshy, sessile, yellowish-green, monothalamous gall of a semicircular outline, the chord of the semicircle adjoining the midrib of a leaf; its general shape like the seed of a Desmodium, or like the so-called "quarter" of an orange, the thin inside edge of the "quarter" closely hugging the midrib of the leaf, and the robust outer surface not biangulated but rounded off. No rosy cheek. The volume of the gall is generally about equally divided between the upper and lower sides of the leaf, but sometimes the lower portion is rather the larger. Usually there is but a single gall on a single leaf, but occasionally there are two of them either on the same side or on opposite sides of the midrib. One leaf was noticed with as many as three of these galls upon it. Length .23—.50 inch; 131 specimens. The above is the appearance of the mature gall July 30; but on May 17 it is already nearly full-sized, and then many of them have a rosy cheek like the normal *S. pomum*. Abundant and not local. Distinct from *S. pomum* by its very different shape, and by its never having any rosy cheek when mature, and by the very distinct species of willow on which it occurs.

Larva. Three or four larvæ examined July 30 did not differ apparently from those of *N. s. pomum* examined on the same day. When the larva quits feeding on the gall, there remains nothing of it but a shell as thin as paper. All the imagos bred by me pupized inside the gall, but there was no earth in the breeding vase for them to retire into, and April 2 I found several dead and dried up larvæ at the bottom.

Pupa unknown.

Imago. Nematus s. desmodioides, n. sp.—♀ Shining greenish-white. *Head* with the eyes, a quadrate spot enclosing the ocelli, and nearly reaching the antennæ, but always separated from the eyes by an orbit which is almost always pretty wide, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 90°. Labrum rounded at tip. Occiput always with a more or less dark black cloud on its upper disk confluent with the ocellar quadrate spot, so as to conceal generally the capillary black lines so conspicuous in *N. s. pomum*. Antennæ ½ as long as the body, joints 3—5 subequal, 6—9 slowly shorter and shorter, 9 sometimes as long as 8, the scape black, the flagellum brown-black. *Thorax*, including the basal plates, black, with the tegulæ, a pair of obscure spots transversely arranged on the scutel and sometimes contiguous, the entire collare, except generally a lateral black spot on its lower angle, and a large obscurely defined triangular spot of variable size on the upper part of the mesothoracic pleura, all greenish-white. Rarely (2 ♀ out of 8 ♀) the mesonotum is dull rufous, with a broad black vitta reaching from the collare to the scutel and the extreme tip of the scutel black, as in many *S. pomum* ♀. Cenchri whitish. *Abdomen*, except generally the extreme tip, black above, the lateral plates black towards the base of the abdomen, greenish-white towards its tip. Basal membrane whitish. Cerci usually greenish-white, rarely tipped with dusky. Ovipositor greenish-white; its sheaths black. Venter always immaculate, tinged more or less with honey-yellow. *Legs* greenish-white, the hind legs sometimes tinged with honey-yellow; tarsal tips, especially in the hind legs, and generally the extreme tips of the hind tibiæ, obfuscated. *Wings* hyaline; veins black; costa and stigma pale dusky, the basal ½ of the stigma tinged with greenish-white. The 3rd submarginal cell varying from ½ longer than wide to a little shorter than wide. In one wing of one ♀ (and also of one ♂) it is entirely absent. Length ♀ .15—.19 inch; front wing ♀ .17—.20 inch.

♂ Differs from normal ♀ only as follows:—1*st*. The quadrate spot enclosing the ocelli is larger and confluent with the eyes or only separated by a capillary orbit. 2*nd*. The occiput is distinctly black, except a narrow orbit. 3*rd*. The antennæ are ⅔ (not ½) as long as the body. 4*th*. The thorax is black, except the tegulæ, and a line on the superior margin of the collare which also extends downwards on its hind margin, all greenish-white. Cenchri whitish. 5*th*. The venter is greenish-white untinged with yellow, the lateral plates black, but terminally a little clouded with pale. 9*th*. The legs are not tinged with yellow. 7*th*. The stigma is uniformly pale dusky. Length ♂ .16 inch, front wing ♂ .17 inch.

Two ♂, eight ♀, bred April 2—15. Distinct from the average specimens of *S. pomum* by the greenish-white (not honey-yellow) ground-color ♂ ♀, by the brown-black flagellum of the antenna ♂, and the black thorax and abdominal dorsum ♀. Specimens however of *S. pomum* ♀ which are abnormally dark are scarcely distinguishable from specimens of *S. desmodioides* ♀ which are abnormally pale; so that, if captured at large, one could scarcely tell which species they belonged to. From certain described species it differs precisely as the preceding. I noticed the difference in the ground color of the two species April 16 in recent specimens when placed side by side.

No. 21*bis*. **Gall S. pisum**, n. sp.—On S. discolor. A subspherical, pea-like, hollow, pale yellowish-green gall, always growing on the under side of the leaf, and almost always from one of the side-veins, very rarely (1 specimen) from the mainrib, and attached to the leaf by only a minute portion of its surface, .18—.28 inch in diameter, and a few, which were probably immature or abortive, only .08 inch in diameter. Almost invariably there is but one gall to one leaf: but on 4 leaves there were two, and on 2 leaves three of them, and occasionally two are confluent. The surface of the gall is without pubescence, in some smooth and even, in others a little shrivelled, generally studded in the medium-sized ones with 4—12 small, robustly conical nipples, which in the larger ones have burst into a scabrous brown scar. Only in 3 out of 62 galls was there any rosy cheek, as in *S. pomum*. The point of attachment is marked on the upper side of the leaf by a brown sub-hemispherical depression about .04 inch in diameter. Abundant but local. Described Aug. 25 from 62 freshly-gathered galls. At the time the 1st part of this Paper was published I was unacquainted with this gall, which accounts for the irregularity in the numbering, (21*bis*.)

On the same bush with the above there occurred 13 galls, mostly unbored, so identical in appearance with *S. pomum* that I did not think it worth while to attempt to breed from them. On Oct. 14, out of another lot of *S. pisum* on another bush of S. discolor, I found that about one-fourth to one-fifth had a slightly rosy cheek. On this bush also I met with 4 *S. pomum* in company with *S. pisum*, but all empty and bored, but whether bored by the Gall-maker or by the inquilinous *Anthonomus sycophanta*, n. sp. (Coleoptera) is uncertain. In both the above two cases a few S. discolor bushes were growing in the midst of

very large numbers of S. cordata, the species on which *S. pomum* is normally found. This gall is evidently allied to those produced by the European *Nematus intercus* and *N. gallarum*, which are described as "globose, spongy, pedunculated galls along the mainrib of the leaf;" (Westw. *Introd.* II, p. 105;) but it differs in growing, not exclusively from the mainrib, but indiscriminately from any of the veins. Distinct from *S. pomum* by its being peduncled not sessile, and by its smaller size and the general absence of a rosy cheek, and from *S. desmodioides* by its short peduncle and by its very different shape.

Larva. The larva on August 25 was apparently 18-footed, with 6 true legs, 12 abdominal prolegs on joints 5—10, but no anal prolegs that I could discover. When at rest, it elevated its entire abdomen behind the true legs in the air, as I notice to be the case, but only in the earlier stages of its life, with a 20-footed larva feeding on the leaves of Salix nigra Aug. 28, from which larva two weeks subsequently I bred six males and eighteen females of an undescribed *Messa*; and as is said to be also the habit of the 20-footed external-feeding larva of the European *Nematus ochraccus*, which also lives on the willow; (Westw. *Intr.* II, p. 104;) except that in these two cases the larva clasps the leaf with some of its anterior prolegs. The length of the larva, Aug. 25, was .17—.23 inch, the body being about six times as long as wide. Color whitish hyaline; head slightly tinged with dusky; mouth dusky; eye-spots circular and black. Anal segment equal in length to two of the others, and apparently divided in two by a transverse medial suture. The larva goes underground to transform; for after my first imago appeared, out of about 50 sound, unshrivelled galls, I found all but 3 bored and nothing remaining of them but a shell as thin as paper. And in those three, when subsequently opened, it appeared that the larva had perished when immature.

Pupa unknown.

Imago. Nematus s. pisum, n. sp.—♀ Shining greenish-white. *Head* with the eyes, a quadrate spot enclosing the ocelli, and extending behind on to the disk of the occiput, but not near reaching the antennæ in front, and separated from the eyes by a pretty wide orbit, a dot above the origin of each antenna, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 90°. Labrum rounded at tip. Antennæ three-fifths as long as the body, joints 3—5 subequal, 6—8 slowly shorter and shorter, 9 as long as 8, the scape black, the flagellum brown-black. *Thorax*, including the basal plates, black, with the tegulæ and the entire collare, except a fuscous spot on each lower angle, all greenish-white. Cenchri whitish. *Abdomen* entirely black, except the venter, and a more or less distinct pale cloud towards the tip of dorsal joint 8; lateral plates black, except the tip of 8. Basal membrane whitish. Ovipositor concealed: its sheaths black. Cerci whitish tipped with dusky. *Legs* pale greenish-white, the tarsal tips, especially in the hind legs, and the extreme tips of the hind tibiæ, fuscous. *Wings* hyaline; veins black; stigma fuscous. Length ♀ .11—.14 inch: front wing ♀ .13—.17 inch.

♂ Differs from ♀ only as follows:—1*st*. The quadrate spot on the vertex is only separated from the eyes by a capillary orbit. 2*nd*. The occiput is black, except a narrow orbit. 3*rd*. The antennæ are 4-5ths (not 3-5ths) as long as the body, the scape black, the flagellum brown-black above, pale dull green beneath.

4th. The collare is black, except a pale line on its superior margin which is prolonged downwards under the wing on its hind margin. *5th.* The lateral plates of the abdomen are black as in ♀, but the venter does not appear to be tipped with black as it does in ♀, because in this sex the lateral plates do not conceal its tip. Length ♂ .11—.13 inch; front wing ♂ .13—.14 inch.

Two ♂, three ♀, bred April 27—June 9. Distinct from the normal *S. pomum* ♂ ♀ and *S. desmodioides* ♂ ♀ by the darker coloration of the body ♂ ♀, and ♂ from *S. desmodioides* ♂ by the flagellum being pale below, which seems a pretty constant character in this family. From an undescribed, cabbage-like, polythalamous, Cecidomyidous gall on the White Oak (*Q. brassica* Walsh MS.), the structure of which is analogous to that of *Cecidomyia solidaginis* Loew, I bred, May 18—June 10, 2 ♂ 7 ♀ of an inquilinous species—*Nematus quercicola*, n. sp.—which cannot be distinguished from the gallmaking *N. s. pisum* ♂ ♀. The habits, however, of the two insects differ remarkably in other respects also. For all my *N. s. pisum* went underground to pupize, and all my *N. quercicola* pupized in the gall. From certain described species *N. s. pisum* may be distinguished in the same manner as *N. s. pomum*. In the ♀ venter being pale and apparently tipped with black from the blackness of the lateral plates, the ♀ agrees with *Nem. corniger* ♀ Nort., the ♂ only of which species has been hitherto described, and differs from all other ♀ *Nematus* known to me, with the exception of *Nem. quercicola*, n. sp. We find the same character in *Euura s. gemma*, n. sp. In a single ♂ the 3rd submarginal cross-vein is represented only by a stump.

Genus **NEMATUS**.—Inquilines or Guest-flies.

Nematus inquilinus, n. sp.—♀ Shining honey-yellow. *Head* with the eyes, a quadrate spot enclosing the ocelli, not near attaining the antennæ, and separated from the eyes by a pretty wide orbit, and also the tips of the mandibles, all black. Clypeus emarginate in a circular arc of about 120°. Labrum prominent and rounded at tip. Occiput generally with a discoidal black cloud. Antennæ full ½ as long as the body, joints 3—5 subequal, 6—8 slowly shorter and shorter, 9 as long as 8, the scape black, the flagellum brown-black. *Thorax* with a broad vitta on the anterior ⅔ of the anterior mesonotal lobe, sometimes reaching to the scutel, the whole of the lateral lobes, or sometimes only the interior ½ of each, the extreme base and tip of the scutel, with sometimes a black line connecting the base and tip, the entire pectus, and part of the pleura, so as to leave above a large triangular honey-yellow spot of variable size, and a cloud on each lower angle of the collare, all black. Metanotum black, the basal plates occasionally with a discoidal honey-yellow cloud on each side. Cenchri whitish. Dorsum of the *abdomen* black, sometimes on all but the last joint, sometimes on two or three of the basal joints only, with two or three of the following sutures dusky, sometimes only on the base of joint 1 with three or four of the following sutures dusky. Lateral plates honey-yellow. Cerci honey-yellow tipped with dusky. Basal membrane yellowish-white. Ovipositor yellowish-

white; its sheaths black. *Legs* greenish-white, the hind legs sometimes pale honey-yellow. Tarsal tips, especially in the hind legs, and the extreme tips of the hind tibiæ, obfuscated. *Wings* hyaline; veins black; costa and stigma pale dusky, the costa and the basal ½ of the stigma sometimes dull greenish-white. Third submarginal cell longer than wide. Length ♀ .22—.26 inch; front wing ♀.24—.27 inch.

♂ Differs from ♀ only as follows:—1*st.* The black spot on the ocelli is much larger, attaining the antennæ, and only separated from the eyes by a capillary orbit. 2*nd.* The disk of the occiput is black, leaving a pretty wide, pale orbit. 3*rd.* The antennæ are ¾ (not full ½) as long as the body, joints 6—9 (not 6—8) slowly shorter and shorter. 4*th.* The meso- and metanotum, tegulæ and cenchri excepted, are entirely black. 5*th.* The dorsum of the abdomen (basal membrane excepted) is entirely black, and the lateral plates are basally black but terminally clouded with honey-yellow. 6*th.* The legs are greenish-white, the hind legs pale honey-yellow, and the whole of the hind tarsi dusky. 7*th.* The costa and stigma are black. Length ♂ .20 inch; front wing ♂ .21 inch.

One ♂, three ♀, bred April 17—18 from the Cecidomyidous gall *S. rhodoides* Walsh. Very like the pale variety of the gall-making *N. s. desmodioides* n. sp., but the ground-color is yellowish not greenish, the antennæ ♀ are proportionally perhaps a trifle longer, and the average size is ⅛—¼ larger. Might be taken for *ventralis* Say, but that species has no triangular pale spot on the pleura, and the joints of the abdominal dorsum ♂ are described as being banded with yellow. Its size is also larger, viz. ♂ .25 ♀ .30 inch. From several other described species it differs as does *S. pomum* n. sp., and from *S. pomum* n. sp. by the large triangular pale spot on the pleura ♂ ♀ which it has in common with *S. desmodioides* ♀.

Nematus hospes, n. sp.—♂ ♀ Absolutely undistinguishable from the normal type of the gall-making *N. s. pomum* ♂ ♀, except that in ♂ the lateral plates of the abdomen are blacker, and as in some ♂ *S. pomum* the dorsal joint 1 in ♂ is lightly tipped with yellow. Length ♂ .17 inch; ♀ .18—.19 inch; front wing ♂ .18 inch, ♀ .20—.22 inch.

One ♂, two ♀, bred from the Cecidomyidous gall *S. strobiloides* O. S. April 7—8. On Feb. 20 I noticed a 20-footed larva burrowing in this gall, which probably belonged to *hospes*, or perhaps to *Euura perturbans* n. sp. which was also bred from that gall. It was about .20 inch long, of a greenish cinereous color, the head darker, with the usual eye-spots and the mandibles blackish; the legs porrect backwards and apparently impotent.

Nematus mendicus, n. sp.—♀ Pale grass-green. *Head* rufous around the ocelli, sometimes tinged with rufous throughout. Eyes, ocelli, a dot behind the ocelli and generally another at each end of a transverse carina half way between the anterior ocellus and the antennæ, and sometimes a dot outside each antenna, and always the tips of the mandibles, all black. Clypeus emarginate in a circular arc of 90°—120°. Antennæ slender, as long as the body, joints 3—5 subequal, 4 sometimes a trifle longer than either, 5 sometimes a trifle shorter than

either, 6—9 very slowly shorter and shorter; the scape black, with joint 1 sometimes pale rufous below, the flagellum brown-black, generally dull rufous or reddish-brown above, except towards the base, always bright rufous beneath, except at the extreme base. *Thorax* tinged with rufous, especially above: a coarse longitudinal line on the disk of each lateral lobe, sometimes with a dot inside its posterior end, and sometimes a slenderer longitudinal line on the front of the anterior lobe, a band near the tip of the scutel, a pair of dots transversely placed in the hollow behind it, an abbreviated band on the succeeding carina, and generally in the hollow between the carina and the basal plate an abbreviated transverse line, and sometimes the edges of the basal plate bordering the basal membrane, all black. *Abdomen* sometimes tinged with rufous; joint 1 sometimes with the edge bordering the basal membrane, and an obscure dot on its dorsal tip, black. Ovipositor concealed; its sheaths tipped with fuscous. Cerci tipped with fuscous. *Legs* greenish-white; tarsi, especially the hind ones, fuscous; extreme tip of the hind tibiæ more or less obfuscated. *Wings* hyaline; veins black; costa and stigma pale green. Length ♀ .22—.24 inch; front wing ♀ .23—.25 inch.

♂ Differs from the normal ♀ only as follows:—1*st.* The body is much slenderer in proportion than is usual in this genus. 2*nd.* The general color is whitish, not pale green. 3*rd.* There is a quadrate black spot enclosing the ocelli and running backwards on to the occiput, swallowing up the black dot on the occiput and confluent with the two black dots behind the antennæ. 4*th.* The antennæ are ¼ longer than the body, joints 3—5 subequal, 5 a trifle the shortest, 6—8 very slowly shorter and shorter, 9 full as long as 8, the scape black, with joint 1 basally pale green, the flagellum rufous above, bright rufous beneath. 5*th.* The entire meso- and metanotum, excepting the pale tegulæ and cenchri, but including the basal plates, is black. 6*th.* In the abdomen the basal ½—¾ of dorsal joints 1—6, nearly the whole of joint 7, and a dorsal line on joint 8, are all superiorly black; lateral plates all whitish; basal membrane whitish. Length ♂ .18 inch; front wing ♂ .19 inch.

One ♂, three ♀, one ♀ bred May 2 from the Tenthredinidous gall *S. pomum* n. sp. of the preceding year's growth, and another ♀, August 5, from the Cecidomyidous gall *S. brassicoides* Walsh of the same year's growth; the other ♀ and the ♂ captured at large. Most probably the larvæ already described (p. 255) as seen Sept. 9 in a jar of *S. pomum* galls belonged to *mendicus*. Comes very near *vertebratus* Say (1 ♀) and *integer* Say (2 ♀), but differs in the antennæ not being entirely black or fuscous, and in the transverse carina behind the antennæ being straight or nearly straight, while in *vertebratus* ♀ it is in the form of a widely truncate angle of 60°, and in *integer* ♀ it forms an angle of about 90° or 100° with its apex a little rounded so as to approximate to a curve. I notice further that *vertebratus* ♀, which in extent of black markings is intermediate between *mendicus* ♀ and *integer* ♀, differs from both in the clypeus being emarginate in a circular arc of only 45°, instead of 90°—120°. But for the above differences, the three species might be considered as varieties, some more highly colored than the others, as in *N. s. pomum* ♀.

Nematus fur, n. sp.—♂ Black. *Head* opaque, very minutely and closely punctato-rugose. Clypeus, labrum, the extreme tip of the cheek, and the base of the mandibles, all dull greenish-white. Clypeus emarginate in a circular arc of about 45°, with a small tubercle in the middle of its anterior margin. Labrum full as long as wide, its tip rounded. Antennæ black, 4-5ths as long as the body, rather more compressed than is usual in ♂, joints 4 and 5 equal in length, 3 shorter by ¼, 6—9 very slowly shorter and shorter. *Thorax* opaque, very minutely rugose, subpolished on the pectus; a pale subtriangular tubercle on the lateral margin of the black subpolished basal plate. Cenchri pale, but not obviously so. *Abdomen* subpolished, bright fulvo-rufous, the basal edge of joint 1 next the basal membrane, which is whitish, clouded with black. Genitals obfuscated. *Legs* black. *Wings* subhyaline, slightly tinged with fuliginous; veins and stigma black. Length ♂ .39 inch: front wing ♂ .38 inch.

One ♂, bred March 29 from an old bored subpedunculed spherical gall, .57 inch in diameter, made by *Cecidomyia s. batatas* Walsh on S. humilis; ♀ unknown. As the mother Saw-fly must have deposited her egg in this gall after the gall-maker had quit it or not long before, it is a question whether, if such be its general habits, this species can be properly considered as an Inquiline. On Feb. 26, however, I found in a recent gall of *C. s. batatas* a pale, greenish-white, Tenthredinidous larva, which may appertain to *fur*, unless it was the larva of *Euura perturbans* n. sp. which I bred from recent specimens of that gall. On April 14—23 I took on the same willow on which the above gall grows 3 ♂, which scarcely differ from *fur*, except in having the abdomen entirely black and the thorax subpolished, and also 2 ♀ ♀ apparently belonging to these ♂ ♂, which had a rufous abdomen. Whether these ♂ ♂ ♀ ♀ are varieties of *fur* or distinct species remains to be proved, but I incline to think them distinct. *Nematus luteotergus* ♂ Norton has honey-yellow, not black legs, and besides it is only ½ the size of *fur*. *Nematus erythrogaster* ♀ Nort. also has legs varied with white and rufous, and is only about ⅔ the size of *fur*. I know no other described species that approaches it.

Genus **PRISTIPHORA**.—Inquiline or Guest-fly.

Pristiphora sycophanta, n. sp.—♂ Black. *Head* polished, but sparsely and rather coarsely punctate. Face with a lofty but obtuse carina extending from between the antennæ to the clypeal suture. Clypeus squarely truncate. Labrum twice as wide as long. Mouth entirely black. Antennæ nearly as long as the body, black above, brown-black beneath, joints 3—5 subequal, 6—9 very slowly shorter and shorter. *Thorax* polished with fine shallow punctures. Tegulæ and cenchri dull yellowish. *Abdomen* polished with fine shallow punctures, sparse towards the base, more dense towards the tip. Basal membrane dull whitish. *Legs* whitish; coxæ, except their extreme tips, femora, tarsal tips, and in the hind legs the terminal ⅓ of the tibiæ and the entire tarsi, all black. *Wings* hyaline: veins black; costa and stigma dusky; first submarginal cross-vein obsolete in both wings, the antepenultimate cell receiving both

recurrent veins in the normal manner. Length ♂ .16 inch; front wing ♂ .16 inch.

One ♂, bred August 9 from a cocoon found, July 27, inside the Cecidomyidous gall *S. brassicoides* Walsh of the same year's growth; ♀ unknown. Distinct at once from *Pristiphora grossulariæ* Walsh, the the only other described N. A. species, by the 3rd joint of the antennæ being as long as the 4th, and by the much darker legs. In the structure of the face and clypeus it agrees remarkably.

COLEOPTERA.

MAKERS OF PSEUDO-GALLS.—Family Cerambycidæ.

No. 22. Pseudo-gall inornata.—On Salix longifolia and also on Populus angulata or Cottonwood. A rather sudden swelling on such of the main stems as are .50—1.25 inch in diameter, cracking open in two or three deep, irregular, scabrous, brown, more or less transverse, gaping, thick-lipped fissures. This is the appearance presented as early as August and until the following spring; but July 19 nothing is seen but a smooth elongate swelling of the stem, pithy inside, and without any cracks or roughness outside, and undistinguishable externally from the Tenthredinidous gall *S. nodus* n. sp., in the form in which it occurs on the same willow later in the season. Very probably, however, as with many, if not with all *Saperda*, the larva is at least two seasons in arriving at maturity, and the normal appearance of the pseudo-gall is not assumed till the following season. The insect does not make its way out in spring through the deep cracks of this pseudo-gall, but each bores a hole for himself in the manner usual in this family. The gall on the Cottonwood is absolutely identical with the Willow-gall, and was recognized by myself as such at the first glance. It was found exclusively on young saplings. In both cases it was perfectly healthy plants that were attacked. Although this pseudo-gall weakens mechanically the stem upon which it grows, and to such an extent that it occasionally causes the stem to break in two with the wind, yet otherwise the stem never perishes, but on the contrary the wound is gradually healed and overgrown by fresh woody matter.

Larva. July 19th the larva is .10 inch long, or less, and of a pale color. In the spring when it assumes the imago state it is much larger, and differs but little from other larvæ belonging to this genus.

Pupa unknown.

Imago. Saperda inornata Say (=S. concolor Lec.?)—May 20, 1864, I bred 5 specimens from the Willow pseudo-gall and many more subsequently. The following year from the Cottonwood pseudo-gall I

bred, June 2 and subsequently, numerous specimens of the same insect. A pair sent to Mr. Ulke were pronounced by him to be *S. concolor* Lec.; but as the insect agrees exactly with Say's description of *S. inornata*, and as LeConte professes to be unacquainted with this last species, (*Say's Works* II, p. 190), I believe *concolor* to be a mere synonym. The most careful authors are sometimes liable to overlook species which have been already described. Many years ago I pointed out to Dr. LeConte that the *Elater obesus* of Say, which he had failed to identify, (*Say's Works* II, p. 109,) was nothing but a pretty common species which, according to him, had been subsequently described by Germar as *Diacanthus acutipennis*, and which now forms the type of the new genus *Oxygonus* Lec. Here both Germar and LeConte failed to identify a species, which Say had circumscribed by a very remarkable character—the tooth on the middle of the tarsal ungues.

INQUILINES.—Family CRYPTOPHAGIDÆ.

LOBERUS IMPRESSUS Lec. Bred a single specimen Sep. 12 from the Cecidomyidous gall *S. brassicoïdes* Walsh. This insect is considered rare, but it occurs abundantly in Illinois in winter-gathered moss. The genus must be carefully distinguished from another bearing the same name in *Telephoridæ*. I do not know which has the priority.

Family MYCETOPHAGIDÆ.

LITARGUS 4-SPILOTUS Lec. Bred a single specimen Aug. 30 from the Acaridous (?) gall *S. æniyma* Walsh. (See above page 227.)

Family CURCULIONIDÆ.

Anthonomus sycophanta, n. sp.—Brown-black. *Head* finely and rather sparsely punctate, except on the vertex, and with short appressed white hairs. A large impressed shallow puncture behind a line connecting the upper curve of the eyes. Rostrum ¼ longer than the head and thorax together, curved in a circular arc of about 45°, finely punctate and rarely with its tip rufo-sanguineous; antennæ inserted 3-5ths of the way to its tip, rufous, the club obfuscated. *Thorax* with close-set larger punctures and long appressed white hairs, so as to appear opaque. Scutel rather longer than wide, generally white with appressed hairs, sometimes blackish or rufous. *Elytra* 1¾ times as long as the head and thorax together exclusive of the rostrum, punctate-striate with large punctures, the interstices with fine rather sparse punctures and white hairs, so that the whole elytrum appears opaque; rufo-sanguineous, sometimes dark sanguineous, rarely verging on to luteo-sanguineous, sometimes with a cloud round the scutel and also the interior edges of the suture, brown-black. All beneath tinged with white from short appressed white hairs. *Legs* dark rufo-sanguineous, the knees and sometimes the entire leg, brown-black. Length exclusive of the rostrum .08—.12 inch.

Eighteen specimens; eleven bred from the Tenthredinidous gall *S. pomum* n. sp., five from the Tenthredinidous gall *S. desmodioides* n. sp., one cut out of the Tenthredinidous gall *S. nodus* n. sp., and one captured at large. This species is the same shape and size as *Anthonomus scutellatus* Schönh. determined by LeConte, (which does not seem to differ from *A. erythropterus* Say,)* but is distinguishable by the elytra being almost entirely red (not red only on the lateral tip) and opaque (not subpolished) from the sculpture of the interstices. I formerly considered *sycophanta* as a mere variety of *scutellatus*,* and have spoken of it under that name. (*Proc. etc.* III, pp. 547 and 619.) But not only do they differ constantly, as has been already shown, but *scutellatus** is inquilinous in the Aphidian galls *Caryæglobuli* Walsh and *Caryæfoliæ* Fitch, in which its imago occurs as early as June 20—26, shortly after which time those two galls dry up to nothing; whereas, out of hundreds of specimens that passed through my hands, the earliest *sycophanta* were met with July 30, and then only in the gall itself.

There is still another *Anthonomus*, of the same size, shape, and nearly of the same sculpture as *sycophanta*, but differing in the head, (except the extreme tip of the rostrum which is black,) the thorax and the legs being of the same rufous color as the elytra, and in the thorax having a conspicuous linear vitta of white hairs extending from the white scutel to the head. Also, instead of an impressed puncture behind the eyes, there is an impressed stria between the eyes; but sometimes, just as in *sycophanta*, there is a blackish cloud round the white scutel, the blackish tint being occasionally prolonged along the suture. Of this species I dug (Aug. 9—18) four imagos and several larvæ out of an undescribed Cecidomyidous gall—*Cratægi plica* Walsh MS—on Cratægus crus-galli; always finding them unaccompanied by the author of the gall, and but a single *Anthonomus* in a single gall. And I have also 11 specimens of the same insect in my Cabinet, labelled as captured on the Thorn. In 1861 Dr. LeConte marked this species for me as "undetermined." Hence, if hitherto undescribed, it may be named *Anthonomus cratægi*. Thus it appears that the same genus *Anthonomus* is inquilinous in Hymenopterous galls made by Sawflies, in Homopterous galls made by Plant-lice, and in Dipterous galls made by

* It appears by a letter which I have since received from Dr. LeConte, that by some clerical error this insect was named by him for me as "*scutellatus* Schönh." instead of its proper designation "*suturalis* Lec." and that it is just as I have supposed in the text, identical with *erythropterus* Say. *Suturalis* (Lec. *Ann. Lyc.* 1824) has the priority over *erythropterus* (Say, 1831), and *scutellatus* is a distinct species.

Gall-gnats. A closet-naturalist, having any one of these galls containing *Anthonomus* submitted to his notice, would be apt to conclude, that it was the *Anthonomus* that made the gall.

On July 29 I found numerous larvæ and two pupæ of *sycophanta* in the Tenthredinidous gall *S. pomum* n. sp., a single individual only in a single gall, in every instance unaccompanied by any Tenthredinidous larva. Nearly one-half, out of a large lot of these galls opened at this date, were thus tenanted, most of them being bored for the exit of the beetle; but two days afterwards I found a single gall occupied by two *Anthonomus* larvæ in distinct cells separated by a thin partition, one cell bored and the other not. Except a single one, none of the galls containing *Nematus* larvæ were then bored. July 31 I found about 12 imagos of *sycophanta* in the gall *S. pomum*, one only in each gall; and August 13—29 I bred large numbers of them from these galls. From these facts I infer that this curculio, while in the larva state, must destroy the egg or the very young larva of the gall-making *Nematus*, just as *Anthonomus cratægi* n. sp. evidently does, and just as the larva of *A. scutellatus** gradually destroys the young plant-lice among which it lives; otherwise the two larvæ would coexist in the same gall. Westwood indeed records the fact, that a *Balaninus* "resides in the large and fleshy galls upon the leaves of Willows, occasionally *in company* with the larvæ of *Nematus intercus*," (*Intr.* I, p. 342,) which last insect he afterwards names as the maker of the gall, stating further that the gall is monothalamous, not polythalamous. (II, p. 105.) But out of hundreds of *S. pomum* that I have opened, I never found the *Anthonomus* larva "in company" with the *Nematus* larva, if by the phrase "in company" is to be understood, that the two insects occur together in the same individual gall, and not merely in the same lot of galls. On July 30 I found two *sycophanta* imagos in the Tenthredinidous galls *S. desmodioides* n. sp., and many others subsequently. And on Aug. 28 I found a single *sycophanta* imago still remaining in the Tenthredinidous gall *S. nodus* n. sp., many of the other galls being bored and empty, from which no doubt the beetle had already made its exit.

Anthonomus tessellatus, n. sp. Rufous, opaque and pulveruleseent with numerous fine, short, appressed, white hairs or elongated scales. *Head* finely and densely punctured; a large puncture between the hind edges of the eyes, which is prolonged between the eyes in a longitudinal stria. Rostrum free from hairs, fully as long as the head and thorax together, arquated in a circular arc of 45°; antennæ rufous, inserted $\frac{2}{3}$ of the way to the tip of the rostrum. *Thorax* more coarsely punctured, $\frac{1}{4}$ wider than long, its sides convex, but slightly constricted

* See the note on page 266.

behind, much and suddenly constricted before, the hairs laterally so dense as to give a silvery-white appearance there. *Scutel* small and never white. *Elytra* 2½ times as long as the head and thorax together, exclusive of the rostrum, more finely punctate than the thorax, and with shallow rather acute striæ irregularly punctate in common with the interstices, (which are flattish,) but not punctato-striate. Lateral margin whitish like that of the thorax: the remaining parts dotted with small irregular masses of white hairs arranged so as to appear almost tessellate. Beneath closely and more coarsely punctate with dense hairs. *Legs* with fine punctures and hairs. Length exclusive of the rostrum .11—.13 inch, with the rostrum .140—.165 inch.

Forty-four specimens, three of which I bred in July from the Cecidomyidous gall *S. brassicoides* Walsh of the same year's growth, and April 19 I noticed one or two more sitting on these galls where they grew, being then of last year's growth. April 20, on beating bushes full of these galls, I obtained prodigiously large numbers. Specimens sent to Dr. LeConte were thought by him to be undescribed. Abundant as it was in April, I never met with it on any other occasion in the ordinary course of collecting, and I believe that the insect is not double-brooded, but that the July specimens were individuals that had attained maturity before the normal time, as with so many other insects. (e. g. the lepidopterous *Batachedra salicipomonella* Clem.; see below, and see also *Proc.* &c. III, p. 569.) A very constant species and easily recognizable by the tessellate appearance of the elytra, which resembles that of *Erirhinus mucidus* Say. Differs from *sycophanta* n. sp., *scutellatus* Schönh. (=*erythropterus* Say ?),* *musculus* Say, *nigrinus* Schönh., *quadrigibbus* Say, *signatus* Say, (which I do not know), *prunicida* Walsh, and many other species, by the elytra not being punctato-striate, except where the general punctation happens to lie in regular series in the elytral striæ. It is also much more elongate than any described species known to me, except *prunicida*.

Larva.—On July 26 I found burrowing in the heart of the gall *S. brassicoides* of the same year's growth a eurculionidous larva, which I have little doubt belongs to this species, or possibly to the following. Length .07 inch, the body usually curved in a semicircle and twice as long as wide. Color yellowish, but above mostly curdy white. Head honey-yellow; mandibles brown-black, robust, and almost equilaterally triangular with a subterminal tooth.

Erirhinus ephippiatus Say. It may be added to Say's rather brief description, that the rostrum is as long as the head and thorax together, and is so nearly straight as to describe a circular arc of 25°. Antennæ inserted on the rostrum ½—3-5ths of the way to the tip. Thorax and elytra shaped as in *Anth. tessellatus*, but rather less elongate. The "slightly indented longitudinal line on the thorax" is an

* See the note on page 266.

optical illusion caused by the hair parting there, and appears and disappears as the light is changed. Besides the two bands on the elytra mentioned by Say, there is a third irregular more or less distinct macular band near their tip. Length .08—.11 inch, exclusive of the rostrum, which in all my specimens is depressed; .10 inch according to Say, nothing being said about the rostrum.

Ten specimens, one of them bred Aug. 11 from the Cecidomyidous gall *S. brassicoides* Walsh, the rest captured at large. The size of the elytral bands varies slightly, but on the whole it is a pretty constant and well-marked species.

Apion lanuginosum, n. sp.—♂? Black. *Head* finely and closely punctate except on the glabrous vertex, and with fine, short, appressed, white hairs; rostrum strongly punctate, except at the extreme tip, but without hairs, basally opaque, terminally subpolished, as long as the head and thorax together, cylindrical throughout, arquated in a circular arc of 45°, thrice as long as wide when viewed laterally, the antennæ inserted 2-5ths of the way to the tip. *Thorax* closely and more coarsely punctate, with very long, rather dense, partially erect, white hairs; as long as wide, its sides behind the middle parallel or scarcely converging towards the scutel, before the middle converging in a concave circular arc of about 30°, so that the thorax is 1-5th narrower before than behind. *Elytra* about 1¾ times as long as the head and thorax together, exclusive of the rostrum, punctato-striate, the striæ deep, the punctures large but not obvious, the interstices rounded and very finely punctato-rugose, with very long, rather dense, partially erect, white hairs. *Legs* and all beneath, black, with fine and short appressed white hairs. Length, exclusive of the rostrum, .07 inch.

Two ♂ (?) specimens, bred Aug. 22 and 29 from the Cecidomyidous gall *S. strobiloides* O. S., and also 1 (♂?) specimen captured at large in company with 2 out of 9 ♀ (?), all of which 9 differ from the description only in the rostrum being ¼ longer than the head and thorax together, and 4½ (not 3) times as long as wide when viewed laterally, and in its having the antennæ inserted scarcely 1-3rd (not 2-5ths) of the way to the tip. I observe similar sexual differences, but much more obvious, in many *Balaninus* which I have taken *in coitu* belonging to *nasicus* Say and *sparsus* Schönh., and the same thing is well known to occur in *Arrhenodes septentrionis* ♂ ♀ Hbst. *A. lanuginosum* differs from *A. rostrum* Say, *A. pensylvanicum* Schönh. and 5 or 6 other species in my collection, by the white hairs giving the insect a distinctly gray appearance, as in *A. segnipes* Say; from which species, however, it is separated at once by the rostrum not being basally thickened and by the legs not being partly rufous. From the description of *A. porcatum* Schönh. it differs also in the cylindrical rostrum, and from that of *A. reconditum* Schönh. in being black, not brassy-black.

So far as I can judge at present, there are very numerous Phytophagic species of this genus, that cannot be satisfactorily separated without breeding large numbers of each from its peculiar food-plant. Dr. LeConte tells me that his collection comprises no less than 35 N. A. species of *Apion*.

Family Galerucidæ.

Haltica alternata Illig. Bred one specimen of the Phytophagic variety with the elytral vittæ subobsolete, (*Proc. etc.* III, p. 404,) Aug. 6, from the Cecidomyidous gall *S. brassicoides* Walsh of the same season's growth, and captured another at large on that gall about the same date. The six specimens with the elytral vittæ distinct but narrow, spoken of (*ibid.*) as captured on that gall, proved on a more careful examination to belong to *H. punctigera* Lec., a closely allied but very distinct species.

Family Chrysomelidæ.

Paria sex-notata Say. Bred one specimen, Aug. 14, from the Cecidomyidous gall *S. brassicoides* Walsh of the same season's growth.

ORTHOPTERA PSEUDONEUROPTERA.—INQUILINES.

Family Psocidæ.

Psocus rufus Walsh. A single specimen of this rare species was bred by me, Sep. 2, from the Cecidomyidous gall *S. brassicoides* Walsh of the same season's growth.

LEPIDOPTERA.—INQUILINES.

Family Ægeriadæ.

Trochilium hospes, n. sp.—♂ Blue-black. *Head* with wide interior orbits and also the lower part of the face, silvery-white. Antennæ blue-black, with the 1st joint beneath, as also the palpi, except their last joint above, golden-yellow. *Thorax* with the edges of the shoulder-covers, and the mesothoracic pleura, golden-yellow. *Abdomen* above with a very narrow band ¼ the way, and a rather wider one ½ way to the tip of the abdomen, and also the lateral edges of the caudal brush, all golden-yellow. Venter with the extreme base and a large spot in the middle occupying about 3 joints, golden-yellow. *Legs* golden-yellow. Front legs with the outside of the femora, black on their basal ¾, and the tips of the tibiæ and the tarsal incisures, all blackish in certain lights. Four hind legs with the coxæ, except their extreme tips, the outside of the femora, the tips of the tibiæ, and in the hind legs their extreme base also, and in certain lights the tarsal incisures, all blue-black. *Wings* hyaline; front wings with a band on the arc and a broad terminal one, streaked with golden-yellow between the veins, blue-black; both wings with the costa partly golden-yellow and the fringe brown-black. Length ♂ .28 inch. Expanse ♂ .57 inch.

One ♂, bred June 2 from the Coleopterous Pseudo-gall *S. inornata* n. sp.; ♀ unknown. On July 4 from a rough, black, woody, undescribed, polythalamous twig-gall occurring sparingly and sparsely, (not abundantly and locally like *Q. podagræ* Walsh,) both on the Black and Red Oaks, (being the same gall from which I bred the Gall-fly referred to by Osten Sacken, *Proc. etc.* IV, p. 365, note,) I bred a ♂ differing from the above only in having the collar slenderly yellow and the extreme tip of the central hairs of the caudal brush distinctly yellow. From a very similar rough, black, woody gall (?), occurring locally and abundantly on the twigs of the Pignut Hickory—the origin of which gall (?) I cannot at present ascertain*—I also bred many years ago a damaged ♂ specimen, which agrees with that bred from the Oak-gall in the characters which separate it from *hospes*. Whether these two last be a mere variety of *hospes* or a distinct species, can only be shown by additional ♂ specimens.† *Hospes* differs from the description of *pyri* Harris by the silvery-white orbits and face, by the basal joint of the antennæ being yellow beneath, by the collar not being yellow, (though it is so in the Oak-gall specimen,) and by the yellow band on the middle of the abdomen being as narrow as in *tipuliforme*, not "broad," as it is described by Harris, or proportionally thrice as broad as in *tipuliforme* as it is figured in Harris's *Injurious Insects*. (Plate V, fig. 5.) From the description of *scitulum* Harris it differs precisely in the same way, except that that species is described as having "the *front* and orbits covered with silvery-white hairs." I notice that *tipuliforme* has the interior orbits silvery-white, though Harris, as quoted by Morris, (*Synops.* p. 140,) omits this character in his description. Possibly, therefore, he may have omitted it also in *pyri*. But, judging from *tipuliforme* ♂ ♀ and *exitiosum* ♀, the width of the abdominal yellow bands is in this genus a pretty constant character.

Family Noctuadæ.

A most surprisingly variable species, as yet undescribed, and expanding only .47—.69 inch, which was originally thought by Dr. Cle-

* Baron Osten Sacken, to whom I have sent specimens, thinks that it is a fungus.

† On Oct. 4, 1866 I bred what is apparently the ♀ of *hospes* from the woody excrescence on the Pignut Hickory of the same year's growth. It differs from the described ♂ only as follows:—1st. The orbits are narrow, not wide. 2nd. The first joint of the antennæ is immaculate. 3rd. The yellow ventral spot is only about half as long. 4th. The lateral fasciculus of the caudal brush, as usual in ♀ *Trochilium*, is much shorter and thinner, but it is still distinctly yellow on its exterior half. Length ♀ .26 inch. Expanse ♀ .50 inch.

mens to belong to *Tortricidæ*, but was finally decided by him to belong to *Noctuadæ*, was bred by me, Aug. 1—23 and subsequently, in prodigious numbers from the Cecidomyidous gall *S. brassicoides* Walsh, and a single specimen from the Acaridous (?) gall *S. ænigma* Walsh,* both of the same season's growth. This is the insect referred to in the note *Proc. etc.* III, p. 609.†

Family Tortricidæ.

Hedya salicicolana Clems. Bred in very large numbers from the Cecidomyidous gall *S. rhodoides* Walsh of the same season's growth, July 27—Aug. 22 and subsequently. Dr. Clemens, following Latreille's example, never gives any dimensions in his descriptions, and I, therefore, here and elsewhere supply the deficiency. Alar expanse .33—.42 inch.

Hedya saliciana Clem. Bred many from the Cecidomyidous gall *S. brassicoides* Walsh, Aug. 1—18, and from the Cecidomyidous gall *S. strobiloides* O. S., Aug. 1—13, both galls of the same season's growth. Expanse .37—.44 inch.

Crœsia gallivorana Clem. Two specimens (♂ ♀?) bred from *S. brassicoides* of the same season's growth, Aug. 14 and 24. Expanse ♀ .77 inch, ♂ considerably less. By some clerical or typographical error, the specific name is printed "gallicolana" twice over in Dr. Clemens's description.

Peronea gallicolana Clem. Bred 12 specimens from *S. strobiloides* Aug. 27—Sep. 11, and one from *S. brassicoides* Sep. 11, both galls of the same season's growth. Expanse .50—.62 inch.

N. B.—*Eurytychia saligneana* Clem. (alar expanse .80 inch) is erroneously stated in Dr. Clemens's description to have been bred by me from a Willow-gall, my letter containing the account of that species having been unfortunately mislaid, and is named accordingly. (*Proc. etc.* V, p. 141.) In reality it was bred in the middle of June from a gall on Solidago (Golden-rod), the same which is referred to by Osten Sacken *Proc. etc.* I, 369. The *Trypeta* gall which Osten Sacken describes in this passage is well known to me, as well as the Dipterous

* See above, page 227.

† In the very last letter which I received from Dr. Clemens, previous to his lamented death, Jan. 11, 1867, he informed me that he had been working on a Synoptical Table of Guenée's *Noctuélites*, and had come to the conclusion that this insect belonged to an undescribed genus. It may assist in identifying it hereafter to state, that I had provisionally named it *protecella*, and it is probably so labelled in the Clemens Collection.

insect which produces it, and it is quite different from the other gall, being roundish and filled, except a central cell, with white sponge, not elongate-oval and with thin walls like the other. But from a gall on the same plant, and also on the allied Compositous plant Vernonia fasciculata, which is externally like the Lepidopterous gall, but is internally filled with brown sponge and numerous cells, I have bred many specimens of *Lasioptera solidaginis* O. S., a minute Cecidomyidous fly. Whether this Dipteron is inquilinous in the Lepidopterous gall, or the Lepidopteron in the Dipterous gall, or whether the two galls are distinct and both the Dipteron and the Lepidopteron are gall-makers, I cannot say with any certainty; but on mature consideration of all the facts now known to me, I incline to the last supposition. As to the burrows in the *Trypeta* galls noticed by Osten Sacken in the above passage, they are probably made by an inquilinous Sawfly; for I found, Dec. 25, a living Tenthredinidous larva, .18 inch long, burrowing in one of these galls, without at all interfering with the health and prosperity of the obese tenant of the central cell.

Family Tineidæ.

Gelechia fungivorella Clem. Bred many from the gall *S. brassicoides* Walsh, Aug. 1—15, and a few from *S. rhodoides* Walsh, (not *S. strobiloides* O. S. as erroneously stated by Clemens,) Aug. 14, both galls being Cecidomyidous and of the same season's growth. Expanse .38—.49 inch.

Gelechia gallægenitella Clem. Two specimens were bred from *S. brassicoides* Aug. 7, and two more, pronounced by Dr. Clemens to be identical, were bred July 2 from the Cynipidous gall *Q. spongifica* O. S., both galls of the same year's growth. Expanse .38—.45 inch. I have since bred two more from last year's specimens of the Cynipidous gall *Q. ficus* Fitch (= *Q. forticornis* Walsh) April 18 and 26. Hence the species would seem to be double-brooded.

Gelechia salicifungiella Clem. Bred six specimens from *S. brassicoides* of the same year's growth Aug. 3—13. Expanse .57—.60 inch.

Batrachedra salicipomonella Clem. Bred many from the Tenthredinidous gall *S. pomum* n. sp. May 8—20, one from the Tenthredinidous gall *S. desmodioides* n. sp. April 9, and one from the Cecidomyidous gall *S. rhodoides* Walsh, May 11, all from galls of the preceding year's growth; also a single specimen Aug. 28 from *S. pomum* of the same year's growth. Expanse .35—.45 inch.

HETEROPTERA.—INQUILINES.

Family Lygæidæ.

Anthocoris [*Reduvius*] insidiosus Say (=*Anthocoris pseudo-chinche* Fitch.) Both larva and imago occur very abundantly on *S. brassicoides* in the summer, and more sparingly on *S. rhodoides* and *S. strobiloides*, all three galls being Cecidomyidous and of the same year's growth. I have also noticed a few larvæ and imagos on *S. ænigma*, and a single larva, Aug. 1, on a leaf covered by *S. semen;* the above two galls being Acaridous and of the same year's growth. This insect is very common, and sometimes occurs under the husks of the ears of maize in the autumn, in company with the notorious Chinch-bug; (*Micropus leucopterus* Say;) for which, to my personal knowledge, it is sometimes mistaken by Agriculturists, although it is only half as large and very differently shaped. Dr. Fitch mentions that, in one instance, it had actually been sent him by a correspondent as the Chinch-bug, whence his specific name. (*N. Y. Rep.* I, p. 294.) Say's description is defective in not stating, that the hind legs are entirely brown-black. What Fitch calls the "variety *semiclarus*" of his *pseudo-chinche*, i. e. with the posterior half of the hemelytral membrane fuliginous, is possibly *Anthocoris* [*reduvius*] *musculus* Say, a very similar but larger and proportionally longer insect, with the hemelytral tips normally fuliginous, and with the tips of antennal joints 2 and 3 and the whole of joint 4, brown-black, the rest of the antenna being pale. The antennal joints, it may be added, are proportioned as in *insidiosus*. Say's specimen of this last species had lost its antennæ, and consequently they are as yet undescribed.

The study of the various Families of gall-producing insects is peculiarly interesting and peculiarly important just now, because it throws considerable light upon the great questions of the day—What is a species? Wherein, if at all, do species differ from varieties? How is one species essentially distinguishable from another? And what was the origin of species? Ordinarily, when we compare together two closely-allied animals, we can only compare them in regard to the different states, that intervene between the earliest embryo and the completely developed adult. This is a strictly zoölogical test. But in the case of the gall-making insects we have, in addition, a botanical test of the highest value; for the characters of the gall are frequently of far more practical importance for the distinction of species, than those of the egg, larva, pupa and ♂ ♀ imago all put together. For example,

1*st*. Certain Willow Gall-gnats, which can be readily distinguished by the galls produced by them, are undistinguishable, as I have shown at great length, in all states of the insects themselves. 2*nd*. The gall *caryæcaulis*, Fitch, grows on the upper surface of the leaf-stalk of a Hickory, (or sometimes, as is correctly stated by Fitch, upon the young succulent twigs of the same year's growth,) and opens above when ripe, to allow the Plant-lice which it contains to escape, by a slit that is usually decussated, or in the form of a +; and this gall often attains quite a large size, say fully ¾ inch in diameter. On the other hand the gall *caryæ globuli* Walsh grows on the leaflet of the same Hickory, and when ripe, opens below, not above, and always by a simple longitudinal slit, as is the general, though not the universal rule in Aphidian galls, *caryæfoliæ*, for instance, opening above at the apex of the conical figure which it presents on the upper surface of the leaflet; and this gall—*caryæ globuli*—never exceeds ½ or ⅓ the extreme diameter of *caryæcaulis*. Yet the *Phylloxera** produced from these two very distinct Hickory galls are absolutely undistinguishable, either by size, shape, structure or coloration, even when numerous specimens of each are placed side by side. (*Proc. etc.* II, p. 462.) It may be thought, perhaps, by those who do not know how constant and invariable a thing a Gall is, and how definitely all its characters are determined by the insect which gives origin to it, that the same insect produces in this particular case a different gall, according to the location of that gall, whether on the stem of the leaf or on the blade of the leaflet. But—not to rely exclusively on the fact, that *caryæcaulis* galls located on the twig are precisely like those on the leaf-stalk—there is another remarkable example, which shows that this can scarcely be so. The Cynipidous gall *Q. ficus* Fitch is, not a bud-gall generated by the deformation of a bud or buds, but a true twig-gall, a mass of subglobular galls about the size of peas being clustered so densely round the infested twig, without in any wise interfering with the normal development of the buds, that, except on the outskirts of the mass, they usually press against one another so closely as to become each 3, 4 or 5-sided. In fact, to make use of Dr. Fitch's graphic comparison, from which he derived his specific name, they closely resemble a mass of round figs, pressed together in the box in which they are packed so as to become many-sided instead of round. Now I have noticed five or six instances, where the mother insect, when depositing her eggs with the accompanying drop of poison in November towards the tip of a

* Respecting this genus, see the note a few pages below.

twig, had evidently "slopped over," so to speak, when she came to the terminal leaf-bud, and had laid a few eggs in the base of the embryo-leaves of that leaf-bud. The consequence was that, when the galls reached their full growth in the following August, there were a few strung along at considerable intervals on the base of one or two of those leaves, that had developed from the terminal leaf-bud since the eggs were laid in the preceding autumn. Here, then, if anywhere, we might expect to find a change in the characters of these wrongly-located galls, produced by mistake in a part of the tree where naturally they had no business to be. But what was the fact? In every one of these five or six cases they were precisely like the outlying galls of a normally located mass of *Q. ficus* galls, differing only from the central ones in being round and not many-sided. They were alike in color, alike in texture, alike in containing internally a mass of very fine, woolly, interlaced fibres, with a central cell located close to the short peduncle of the gall; (for these galls are not "hollow," as is incorrectly stated by Fitch and re-stated by Osten Sacken;) finally they were precisely alike in size. Yet, as the change in location in this example was the greatest possible, namely, from a twig to a leaf, here, if anywhere, we might have expected some little variation in the aberrant gall. Is it likely, then, that when the change in location is merely from one part of a leaf to another, namely, from the footstalk to the leaflet, we should meet with fundamental differences in the structure and size of the same identical gall, as we must assume to be the case, if we assume that *caryæcaulis* Fitch and *caryæ globuli* Walsh are produced by one and the same species of *Aphidæ?* Moreover, *caryæcaulis* is comparatively rare near Rock Island, Illinois, and *caryæ globuli* very common, while on the contrary Dr. Fitch found *caryæcaulis* very common and was entirely unacquainted with *caryæ globuli*. *3rd.* An inquilinous Saw-fly—*Nematus hospes* n. sp.—which inhabits a Willow-gall made by a Gall-gnat, is undistinguishable from a true gall-making Saw-fly—*Nematus s. pomum* n. sp.—which I have bred very extensively from a well-marked Willow-gall. (See above, p. 261.) *4th. Nematus quercicola*, n. sp. (see above, p. 260), which is inquilinous in a Cecidomyidous bud-gall on the White Oak, positively cannot be distinguished, when the two are placed side by side, from *Nematus s. pisum* n. sp., which makes a leaf-gall on Salix discolor. *5th.* Many specimens of another inquilinous Saw-fly—*Euura perturbans* n. sp.—which I have reared from a variety of different galls made by Gall-gnats, are absolutely undistinguishable from specimens bred by myself of the gall-

making *Euura s. ovum* n. sp., which inhabits a certain well-characterized Willow-gall. (See above, p. 254). 6*th* and *lastly*. In the case of *Cynips q. spongifica* O. S. and *C. q. inanis* O. S., the ♂ ♀ gall-making imagos, produced in the same month of the year from very distinct galls occurring exclusively on very distinct Oaks, cannot be distinguished in any way from one another when placed side by side, as both Osten Sacken and myself have clearly ascertained.*

The general rule with all gall-making insects seems to be, that each particular species is confined to one particular species of the genus or genera of plants, inhabited by the particular genus of insects to which it belongs. But there are very numerous exceptions to this rule; and those in the family *Cynipidæ* will be found collected together in the first part of this Paper, where it is shown that even then the *Cynips* always restricts itself to one or other subgenus or section of the botanical genus Quercus. (Pp. 638—9, note; see also Osten Sacken's fourth Memoir on *U. S. Cynipidæ*, *Proc. etc.* IV, p. 342.) Now it is a most remarkable fact, that in all these cases, so far as known to me—and I could now add some others to the list—the galls, although they occur on different Oaks, are absolutely undistinguishable; and under similar circumstances the same thing is true, so far as my experience extends, of Cecidomyidous galls, †of Aphidian galls,‡ of Tenthredinidous galls,||

* The specific distinctness of these two *Cynips* has been questioned by Dr. Reinhard of Germany, but I hope to prove it in a second Paper on Dimorphism in *Cynipidæ*. Dr. Reinhard's suggestion is that they may both of them be inquilines, belonging to the same species.

† Galls *S. strobiliscus* Walsh, (doubtful) on Salix rostrata and S. discolor: *S. gnaphalioides* Walsh on S. humilis and S. discolor: *S. siliqua* Walsh on S. humilis, S. discolor, S. rostrata, S. cordata and S. petiolaris: *S. batatas* Walsh on S. humilis, S. discolor and S. cordata (?): *S. verruca* Walsh on S. humilis and S. discolor: and a precisely similar gall on Solidago (sp. ignot.) and Vernonia fasciculata producing from each *Lasioptera solidaginis* O. S., which may, however, possibly be an inquiline and not a gall-maker. (See above, p. 273.)

‡ Gall *vagabunda* Walsh, on Populus angulata and P. balsamifera. The Hickory galls *caryæcaulis* Fitch, *caryæfoliæ* Fitch and *caryæ globuli* Walsh (all three formed by Aphidians) occur, so far as I have observed, locally and abundantly on the Shag-barked Hickory, (Caryæ alba,) and scarcely ever on the Pignut Hickory, (C. glabra,) but on whichever species of Hickory they occur, they are exactly alike. The gall *ulmicola* Fitch (which I have shown to be made by a *Thelaxes?*) occurs, so far as I can perceive, only on the White Elm, (Ulmus americana,) or, as I incline to believe, on an undescribed species of Elm, which has a leaf intermediate in roughness between those of the White and Red Elm, (U. fulva,) never exceeds 25 or 30 feet in height, has a much more upright habit than either the White or the Red Elm, has timber easily split, instead of remarkably tough and locky as in the case of the White Elm, and is popularly known in the West as "Hickory Elm." The case of an Aphi-

and even of Coleopterous Pseudo-galls.* It will be contended perhaps that I am arguing in a circle, and that when, as in the case of Baron Osten Sacken's two *Cynips*, the galls are quite different and the insects exactly alike, then I consider the insects as distinct species; and when both the galls and the insects are exactly alike, then I consider the insects as the same species, thus in effect assuming the existence of the very criterion which I am attempting to prove. But there are no intermediate grades between these two cases to prove their similarity; which would inevitably take place if the criterion in question had no real existence in Nature. Osten Sacken's two Oak-galls, for instance, are so totally unlike each other internally, that out of a thousand specimens of each it would be impossible to find any two, that the most ignorant person would be likely to confound; and the same thing may be said, with occasionally a few grains of allowance, of the other instances adduced above. (§§ 1*st* and 2*nd*.) Whereas in the other class of cases, where, in galls made by Gall-flies, Gall-gnats, Plant-lice, and Saw-flies, both the galls and the insects are alike, the galls that occur on different species of the same genus of plants resemble one another so closely, that, on the most attentive study of very numerous specimens, no constant distinctive character whatever can be discovered. Nay, it has even been found by Dr. Ratzeburg, as quoted by Osten Sacken, that a European Gall-fly, *Cynips fecundatrix*, inhabiting normally a European species of Oak, produced the very same kind of galls when it attacked some American Oaks in his garden, that it produced on the European Oak. (*Proc. etc.* I, p. 248.)

But even if we tide over the difficulty, by assuming that all the similar pairs of gall-makers producing distinct galls are identical, what can we do with the 3 examples referred to above among the Saw-flies, where the inquilinous species are apparently identical with gall-making species? (§§ 3*rd*—5*th*.) Are we to believe that each of these 3 pairs of so-called species are really identical, and that one and the same species sometimes makes galls for itself, and sometimes inhabits a variety of totally distinct galls made, not by Saw-flies, but by Gall-gnats? I

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dian, inhabiting undistinguishable galls on two distinct species of Rhus, will be noticed below.

‖ Gall *S. pomum* n. sp. on Salix cordata and S. discolor, (the imago not reared from the latter); *S. ovum* n. sp. on S. cordata and *S. ovulum* n. sp. on S. humilis. (Most probably distinct species; the imago not bred from the latter and the larvæ constantly of a different ground color.)

* Pseudo-gall *inornata* n. sp. occurring both on Salix longifolia and on Populus angulata.

could as soon believe, with the schoolboy in the story, that sometimes the Earth went round the Sun and sometimes the Sun went round the Earth. I could as soon believe, contrary to all ornithological authority, that the European Cuckoo or our North American Cowbird sometimes builds a nest for itself and sometimes oviposits in the nests of other birds. I could as soon believe, that the bees belonging to the genera *Nomada* and *Cœlioxys* sometimes build and provision nests for their own young, and sometimes surreptitiously oviposit in the nests of *Halictus* and *Megachile*. But, unless we believe in such anomalies as these, we are bound to believe that perfectly distinct species may in the imago state be apparently identical, and that the galls form the only distinctive character between them. That these inquilinous Saw-flies were primordially identical with the gall-making Saw-flies, and that Osten Sacken's two Gall-flies were primordially identical, and the undistinguishable Willow Gall-gnats were primordially identical, and the undistinguishable Aphidians *Phylloxera* (?) *caryæcaulis* Fitch and *Ph.* (?) *caryæ globuli* Walsh, were primordially identical—I fully concede. On no other hypothesis can I account for the fact of so many pairs of species being exactly alike, so far as the insects themselves are concerned; just as, when I find two copies of the same book exactly alike, I account at once for the fact by assuming that they were stricken off from the same types. But that is quite another affair from all these pairs of species being identical at the present day.

Negative facts are always more or less unreliable; but there is one negative fact, or rather bundle of facts, upon which I scarcely think that I can be mistaken throughout, though I may be, and doubtless am, mistaken in some few of the details. Not only is it the case, as I have already partly shown, (*Proc. etc* III, p. 635,) that, when a given genus of gall-making insects occurs on a given genus of plants, it is very generally represented thereon—if we include exotic as well as domestic insects—by several species and often by very numerous species; not only is it the case, as I have already indicated elsewhere, (*Proc. etc.* I, p. 310, II, p. 461,) that each gall-making genus of true insects, with the single very remarkable exception of *Cecidomyia* and its subgenera, is, as a general rule, restricted to one single genus of plants;* but it is also the case that—putting the gall-making *Cecidomyia* which

* It matters little for my argument, whether we assume that these peculiar forms restricted to particular genera of plants are genera or subgenera or mere generic sections. It is sufficient that they are proved to be structurally distinct from other forms. The rest, after all, is more a question of words than a question of things.

are true insects, and the gall-making *Acaridæ* (mites) which are not true insects, out of the question—the gall-bearing genera of plants are themselves exceedingly limited in number. Take the different genera of North American trees and woody shrubs, for example, and—excluding all galls made by Gall-gnats and by Mites—count up all the other North American galls which are met with thereupon, entirely omitting all exotic galls. Celtis (Hackberry), as it will be found, has *three* galls, all Psylladous, and two of them and probably all three produced by what is probably an undescribed genus of the Homopterous family *Psyllidæ*. (*Proc. etc.* II, pp. 461—2.) Ulmus (Elm) has *one* gall, produced by *Thelaxes* (?)* a genus of the Homopterous family *Aphidæ*. Populus (Poplar) has at least three galls produced on P. angulata by *Pemphigus* (*Aphidæ*),† and two more, *populiglobuli* Fitch and *populivenæ* Fitch, produced on P. balsamifera by the same genus; besides two new species, evidently Aphidian, which I have found respectively on P. tremuloides and P. grandidentata (?), after the gall-makers had deserted them—thus making in all *seven* galls. Hamamelis (Witch-hazel), which is not found near Rock Island, Ill., has, according to

* *Thelaxes ulmicola* Walsh. I suspect that I have erred in referring this insect to Westwood's genus *Thelaxes*, which is said to have the "anterior" one of the three discoidal veins bifid. In *ulmicola* it is the *posterior* one, or what may be less ambiguously termed the *terminal* one, that is bifid. Possibly, however, "anterior" may be a clerical error for "posterior." The European type of *Thelaxes* inhabits the Oak and not the Elm.

† I have hitherto erroneously referred these three species to *Byrsocrypta*, a genus founded by Haliday and apparently synonymous with *Tetraneura* Hartig, and which differs from *Byrsocrypta* as limited by myself by having only one, instead of two discoidals in the hind wing. I was led to separate generically these gall-making *Pemphigus* from certain root-inhabiting *Pemphigus* which I have described, 1st, because their antennal structure differed somewhat, and 2nd, because I was unwilling at that day to believe, that the same genus could contain both gall-making and non-gall-making species. But, 1st, I am informed by Baron Osten Sacken that the European *Pemphigus bursarius*, which also inhabits Poplar galls, has, according to Koch, antennæ like those of my root-inhabiting *Pemphigus;* and 2nd, as has been already observed, (ante, p. 237,) there are several groups, both Hymenopterous and Dipterous, that contain both gall-making and non-gall-making species, and there are even some groups, such as *Nematus* and *Cecidomyia*, that contain both Gall-makers, Guest-gallflies, and External Feeders.—I have described the gall of *Pemphigus* [*byrsocrypta*] *pseudobyrsa* Walsh, as "entirely open below, the sides of the leaf bending down together so as to touch each other and conceal the opening." (*Proc. etc.* I, p. 306.) This is applicable only to the *mature* gall, when, as is usual with Aphidian galls, it opens out to allow the winged insect to escape. On May 20 the *immature* gall is completely closed, but, as usual, with a slit below; and at this date it contained one large apterous Aphidian and a few small larvæ. Hence this is a true gall, and not, as I inferred, a false or spurious gall.

Fitch, *one* gall, produced by an Aphidian which he referred to the genus *Byrsocrypta* in 1851. (*Catal. Homopt.* p. 69.) Baron Osten Sacken, however, has kindly informed me, that he long ago bred the winged insect from this same gall, and that it belongs to a new Aphidian genus which in 1861 he had proposed to call *Hormaphis** in allusion to the moniliform antennæ. Pinus (Pine), as I am informed by Baron Osten Sacken, bears at least *one* North American cone-like gall, produced by the Aphidian genus *Chermes*, besides others produced by the same genus in Europe. Rhus (Sumac) has at least *one*, and not improbably two galls, produced by a new Aphidian genus closely allied to *Pemphigus*, and differing from that genus chiefly in having 4-jointed, not 6-jointed antennæ.† Cornus (Dogwood) has, to my

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* "This black *Aphis*, powdered with white, is characterized by the structure of its antennæ. The ring-like wrinkles upon the joints, which occur also in *Tetraneura*, are so deep here, that the flagellum appears to be moniliform, and the real size of the joints is not perceptible. This apparently new genus may be further distinguished from *Tetraneura* by the two first oblique veins forming a fork together. I propose for this genus and species the name of *Hormaphis hamamelidis*." (Osten Sacken apud *Stettin. Entom. Zeitung*, 1861, p. 422.) The translation is by the author himself, who also informs me, that he was not aware at the time, that ten years previously Dr. Fitch had given the same specific name to the same insect. It is not often that conflicting synonymies are so happily avoided, by two different authors hitting on precisely the same specific name.

† In this genus, which may be called *Melaphis* in allusion to the fruit-like appearance of the gall, the typical two joints of the scape are soldered together so as to form one joint (the 1st), the typical joints 1 and 2 of the flagellum are soldered together so as to make one joint (the 2nd) nearly half as long as the rest of the antenna, and the 4th or last joint is at least as long as the 3rd, and bears, as in *Pemphigus*, a minute, terminal unguiculus, fore-shadowing the typical 7th joint found fully developed in *Aphis*. Dr. Fitch has recently described one species of this genus, under the name of *Byrsocrypta rhois*, in the *Jour. N. Y. State Agr. Society*, (Aug., 1866, p. 73.) referring it to *Byrsocrypta* rather than to *Pemphigus*, because, as he says, "out of five unmutilated specimens only two had hind wings with *two* oblique veins," the other three, I suppose, appearing to him to have but *one* oblique or discoidal vein in the hind wing. I have examined probably over two hundred specimens of this species, and find that every one without exception has *two* discoidal veins in the hind wings. Hence I cannot but suspect that Dr. Fitch's eyes must have deceived him on this point. The antennal joints are normally proportioned nearly as $1\frac{1}{2}$, 5, 2, 3; but out of 28 recent specimens, in which I carefully examined both antennæ with a Coddington lens, I found that no less than 13 out of the 56 antennæ were distinctly 5-jointed, the very long 2nd joint being resolved into one long and one short one; thus proving that the 2nd joint is in reality, as stated above, formed by the confluence of joints 1 and 2 of the typical flagellum of *Aphidæ*. It may be added that the same individual often had one antenna 4-jointed and the other 5-jointed.

knowledge, *one* undescribed gall growing on the flower-cymes probably of C. stolonifera, the insect unknown to me, but the gall itself manifestly Aphidian. Carya (Hickory) has three galls, produced by a new genus closely allied to *Phylloxera* (*Aphidæ*,)* and found almost exclu-

Dr. Fitch's description of the winged ♀ of this species applies only to immature specimens extracted from the gall. After they have been out some time, the legs and the whole body, except the collar which becomes very pale brown, turn to a decided black; and the stigma then is not "salt-white," but pale dusky with a whitish reflection. I am indebted to Dr. William Manlius Smith, of Manlius, N. Y., for my first acquaintance with this gall, which he has found abundantly in that locality for many years back on Rhus typhina. But I have since (Aug., 1866) met with numerous specimens myself near Rock Island, Ill., on Rhus glabra. He assures me—which I can readily believe—that Dr. Fitch is altogether mistaken in saying, that in young galls the larvæ are usually accompanied by a single *winged* female. In all Aphidian galls known to me the mother-louse is apterous, and has probably hybernated either in the egg or larva state.

There is another and a much larger and very distinct species of this genus *Melaphis*, of which Dr. Smith took a single female early in June on a sumac leaf in a clump of Sumacs. Soon after capture this individual gave birth on Dr. Smith's finger, to what was so completely enveloped in a thin membrane, that it seemed at first to be an egg under the lens, though it shortly afterwards developed into a larva. He informs me that he has since repeatedly noticed the same phenomenon in winged specimens of *Melaphis rhois* freshly escaped from the gall; and Curtis observed the same thing in England in the case of an *Aphis* found on the turnip. (*Farm Insects* p. 65.) As this female captured in June, which through Dr. Smith's kindness is in my collection, differs from *M. rhois*, not only in being fully twice as large, but in the stigma being scarcely longer than wide, instead of 3—3½ times as long as wide, I infer that it is a distinct species, inhabiting the Sumac and coming out in the winged form in June instead of September. It may possibly be an external feeder, or it may make a gall on Sumac distinct from that of *M. rhois* and probably a root-gall, as Dr. Smith was unable, on careful search in the open air, to find any other Sumac-galls than those of *M. rhois* in the vicinity of the spot where he captured the specimen.

Dr. Smith has kindly referred me to an Article by Prof. Archer of England, reprinted in the *American Journal of Pharmacy*, April, 1865, from which it appears that there are two Chinese, one Japanese, and one Indian gall, growing on different species of Rhus, and apparently analogous in their structure to our American sumac-gall. In regard to one of the Chinese galls, supposed to grow on Rhus semialata, and called "Woo-pei-tze," it is stated that "Mr. Doubleday, the entomologist, has shown that it is caused by an *Aphis* and not by a *Cynips*;" and I have little doubt that all these exotic sumac-galls are Aphidian. It would be very interesting to know whether the Plant-lice found in them are generically related to ours. The galls themselves are described as some of them like a radish-pod, some like an ox-horn and 2—2½ inches long, and some "branched" and apparently like a stag's horn. Our species is a good deal like a common tomato, whence I had given it the MS. name of *Rhois tomatas*.

* This genus differs from the European *Phylloxera* (which inhabits the Oak)

sively on the Shell-bark (C. alba) in June; besides an undescribed gall (*Caryæ pilula* Walsh MS.), which I found, after the insects had deserted it, very abundant but local on the leaflets of the Pignut Hickory (C. glabra) in July, and which is thought by Osten Sacken, to whom I communicated specimens, to be manifestly Aphidian; in all *four* galls. But besides the above four Aphidian galls, Carya possesses at least *two* Coccidous galls, namely, *caryævenæ* Fitch, which I find exclusively on the Shell-bark Hickory in August, and which is described by Fitch as Aphidian, and doubtingly referred to the genus *Pemphigus*, and *Caryæ semen* Walsh MS., a gall of the size and shape of a cabbage-seed, which I find in prodigious numbers on the leaflets of the Pignut Hickory in July.* Vitis (Grape) also bears at least *one* gall produced by *Coccidæ*, namely, *vitifoliæ* Fitch, which I find very abundantly in July, August and September, on a species of wild grape, V. cordifolia, and also on the cultivated variety of that species known as the Clinton grape, and in much smaller numbers on the cultivated Delaware grape, but not on any cultivated varieties of other species of wild grape, even when they grow promiscuously intertwined with Clin-

in the two discoidal veins of the front wing uniting in a fork, instead of being perfectly separated. I propose for it the name of *Xerophylla*, which is composed of the same Greek elements as *Phylloxera*, but is rather better Greek. According to Amyot as quoted by Fitch, (*N. Y. Rep.* II, § 166), the European *Phylloxera* differs also very remarkably from our *Xerophylla*, and from all other known Aphidians, by having no subcostal vein at all; but this, as Fitch suggests, is probably an error. Respecting our generic form Osten Sacken has remarked as follows:—"It does not answer to the characters of any of the genera mentioned in Ratzeburg or Kaltenbach; (Koch I do not possess.) The antennæ are apparently 4-jointed: the 3rd joint occupies the greater part of the antenna; the last joint is very short and ends in two small bristles as in *Psylla*. Wings almost like those of *Phylloxera*, but the two first oblique veins unite in a distinct fork." (*Stettin Entom. Zeitung*, 1861, p. 421.) Fitch, by the way, observes, in the passage referred to above, that "none of the figures in Koch's works correspond with these insects, and the genus to which they pertain is evidently unknown to him." But in Koch's book, as Baron Osten Sacken informs me, the genus *Phylloxera* occurs in the list of genera at the beginning, though it is neither described nor figured, in consequence of the work having been published from the author's unfinished papers.

*That these two galls are Coccidous, not Aphidian, may be inferred from the fact, that the tarsi of the mother-lice are 1-jointed, not 2-jointed. And besides, Dr. Fitch himself describes the mother-lice of *caryævenæ* as laying eggs, and the same remark applies to those of *Caryæ semen*; whereas all true gall-making Aphidians that are known to me are viviparous so long as they live in the gall. Moreover, all gall-making Aphidians that are known to me remain in the gall, till they have reached maturity and most of them acquired wings; whereas in these two galls the young larvæ, almost as soon as they have hatch-

ton vines swarming with these galls.* Amorpha (False indigo) has *one* gall, produced by a small moth (Lepidoptera) belonging to a new genus which bears my unworthy name— *Walshia amorphella* Clemens.† Salix (Willow) has *seven* galls produced by Sawflies (Hymenoptera), namely, one bud-gall and three twig-galls produced by *Euura*, and three leaf-galls produced by *Nematus*, all described for the first time in this Paper. Rosa (Rose) has *six*, produced by the Hymenopterous genus *Rhodites* (*Cynipidæ*). Rubus (Bramble) has *two*, produced by *Diastrophus* (*Cynipidæ*). And finally Quercus (Oak) has no less than *fifty-eight* galls, according to Osten Sacken's latest revision, produced by *Cynips* and its subgenera; and I am myself acquainted with numerous others, which are at present undescribed. The sum total of all these galls, found on fourteen different genera of N. A. trees and shrubs, is 96.

On the other hand—always excepting, as before, galls made by those

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ed out, stray away to found new galls, leaving the mother-lice behind them to lay from time to time fresh eggs. Again, all gall-making Aphidians that are known to me secrete a sugary dust or flocculent matter while in the gall, while these gall-making *Coccidæ* do no such thing. It is further remarkable that in a single *caryævenæ* gall, two, three or even four mother-lice are often found, in company with numerous eggs, or freshly hatched larvæ, or some eggs and some larvæ; whereas I do not remember ever to have found more than a single mother-louse in any single gall known to be produced by a Plant-louse.

*Dr. Fitch supposed his *vitifoliæ* gall to be Aphidian, and referred the wingless female which he met with inside it in June to the genus *Pemphigus;* but it appears to be in reality Coccidous, for precisely the same reasons as in the case of the Coccidous gall *caryævenæ* found on Carya. What is very remarkable, the two or three winged males, obtained by Dr. Shimer of Illinois by opening many thousands of these galls, though they are described by him as having one-jointed tarsi, have four wings, (instead of the pair of wings and the pair of balancers, which are found in all described Coccidous genera,) the front wing, as I am informed by Mr. Cresson, with a subcostal and a basal discoidal vein almost precisely as in *Coccus*, but no other distinct veins, the hind wing with an obscurely defined subcostal only. Hence it becomes evident, that this insect cannot be referred to any genus of *Coccidæ* named and described by authors, and must become the type of a new and very aberrant genus. Although gall-making *Coccidæ* are unknown in Europe and hitherto in America, yet Baron Osten Sacken has kindly informed me, that in the Transactions of the Vienna Zoological and Botanical Society there is an account of various galls produced by true *Coccidæ* in Australia, "some of which *Coccidæ* are an inch long, the males producing galls of different shape from those of the females."

† I am quite sure that this gall is really produced by the moth, of which I have bred scores of specimens and am well acquainted with the larva. Stainton mentions the discovery by Grabow of a gall-producing Lepidopterous larva in Europe as of "extreme interest." (*Entom. Ann.*. 1856, p. 57.) And Osten Sacken has referred to another such case in Europe. (*Proc. etc.* I, p. 369.)

cosmopolites, the Gall-gnats and the Mites—I know of no gall on Clematis (Virgin's-bower), on Fraxinus (Ash), on Betula (Birch), on Platanus (Plane-tree), on Juglans (Walnut), on Pyrus (Apple, Pear, &c.), on Cratægus (Thorn), on Prunus (Plum), on Cerasus (Cherry), on Persica (Peach), on Ribes (Currant and Gooseberry), on Syringa (Lilac), on Corylus (Hazel), on Ostrya (Hop-hornbeam), on Morus (Mulberry), on Maclura (Osage-orange), on Robinia (Locust), on Gleditschia (Honey-locust), on Cercis (Redbud), on Gymnocladus (Coffee-tree), on Tilia (Basswood), on Viburnum (Black-haw, Snowball-tree or Guelder-rose, &c.), on Lonicera (Honey-suckle), on Sambucus (Elder), on Cephalanthus (Button-bush), on Ceanothus (Red-root), on Euonymus (Burning-bush), on Ptelea (Hop-tree), on Ampelopsis (Virginia Creeper), on Xanthoxylum* (Prickly-ash), on Acer (Maple), on Negundo (Box-elder), or on Juniperus (Juniper).† I have enumerated here only those N. A. genera of Trees and Shrubs, with one or more species of which I am familiar—which I have diligently searched for galls—and in which, if galls existed on the species known to me other than Acaridous and Cecidomyidous galls, I think I should have found them, at all events in the great majority of cases. But even these genera foot up to 33.

As illustrative of the comparatively general distribution of Acaridous and Cecidomyidous galls, it may be worth while to give the following abstract of their occurrence, so far as known to me, among the genera of the above two lists.—In the first list, Celtis bears 5 Cecidomyidous galls belonging to new and undescribed species. Ulmus bears 3 Acaridous galls n. sp. Populus bears 1 Acaridous gall n. sp. Pinus bears

* Commonly, but incorrectly, spelt Zanthoxylum, though Dr. Gray in his Manual gives the correct derivation from the Greek. Evidently the botanist Colden mistook here a ξ for a ζ, just as the entomologist Fitch, when he composed his Cynipidous new genus *Philonix* (properly *Philonips*) mistook a ψ for a ξ. Inconsistently enough, the botanical genus Xanthium, which is derived from the very same Greek root, is always spelt with an X and never with a Z.

† The Red Cedar belongs to this genus, but I have shown in the *Practical Entomologist*, (I, pp. 49—51,) that certain gall-like bodies which are attached by a very short pedunele to its twigs, are not Galls, but a congeries of Epiphytous Funguses. On April 8 these reddish-brown sub-globular bodies, which average ½—¾ inch in diameter, had on their surface many circular depressions, often with a very flat central nipple, the specimens then cut into being whitish and fleshy inside, but not juicy. On April 28 filaments about ½ inch long and five times as long as wide, of a cylindrical shape and but slightly tapered at tip, had shot forth from these circular depressions, and were then covered with ferruginous dust, supposed to be the spores. On May 15 these filaments were ¼ inch long, and seven or eight times as long as wide; but already some had fallen off,

2 Cecidomyidous galls described by Osten Sacken. Cornus bears 2 Cecidomyidous galls n. sp. Carya bears 8 Cecidomyidous galls described by Osten Sacken and no less than 13 n. sp., besides 1 n. sp. which is apparently Acaridous. Vitis bears 2 Cecidomyidous galls described by Osten Sacken and 2 n. sp. Salix, as has been shown in this Paper, bears 13 Cecidomyidous galls (Nos. 1—13), and at least 2 Acaridous galls (Nos. 14 and 15) and probably several others. Rubus bears 1 Cecidomyidous gall described by Osten Sacken. And Quercus bears 4 Cecidomyidous galls described by Osten Sacken, 1 described by mistake by myself as Cynipidous, (*Q. pilulæ*,) and 3 n. sp., besides many Acaridous semi-galls or mere woolly indented deformations of the leaf. —In the second list, Fraxinus bears 1 Cecidomyidous gall described by Osten Sacken, and 2 Acaridous galls n. sp. Betula bears 1 Acaridous gall n. sp., being that referred to above (*Proc.* &c. III, p. 608) as apparently Cecidomyidous. Juglans (two species) bears 2 Acaridous galls n. sp., but not a single Cecidomyidous one, although the closely allied Carya (two species) bears as many as 21 of them. Pyrus bears 1 Cecidomyidous (?) gall n. sp. Cratægus bears 4 Cecidomyidous galls n. sp. and 1 Acaridous gall n. sp. Prunus and Cerasus bear each 1 Acaridous gall n. sp. Corylus bears 1 Cecidomyidous gall n. sp. Robinia bears 2 Cecidomyidous galls described respectively by Haldeman and Fitch. Gleditschia bears 1 Cecidomyidous gall described by Osten Sacken. Tilia bears 3 Cecidomyidous galls n. sp., one of the three of doubtful origin, and 1 Acaridous gall n. sp. Cephalanthus bears 1 Acaridous gall, being that referred to above, (*Proc.* &c.

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leaving certain depressed round scars, which may always be seen on all the old dry specimens of last year's growth that still adhere to the twigs. These last may always up to this time be readily distinguished, by their being internally ferruginous, and of a hard, spongy, subligneous texture. Finally, by May 20 the apical ½ of the filaments had withered up and shed its ferruginous spores, shortly after which they all fell off and disappeared entirely. It is to these funguses that, I suppose, Dr. Fitch alludes, when he speaks of "rounded galls on the leaves and twigs" of the Red Cedar in New York, which he infers to be produced by Gall-flies (*Cynipidæ*). (See *N. Y. Rep.* II, § 285.) I find that in Kansas, and probably elsewhere, they are popularly known as "Cedar-apples." It is remarkable that in Europe, according to Fries and Berkley, the "savin-tree, (juniperus)," by which I understand our common Red Cedar to be intended, bears similar "cedar-apples" having "long orange-colored spurs formed by the spores." (Flagg *on Fungi in Missouri Agr. Rep.* 1865, append. p. 186.) It is said also by the same authors to be "attacked by a peculiar gum (podisoma), which bursts from its bark and swells under the influence of moisture to a gelatinous mass." I have repeatedly noticed the same phenomenon on our Red Cedar in the United States.

III, p. 608,) as apparently Cecidomyidous. Ampelopsis bears 1 gall, evidently from its structure Cecidomyidous. Acer bears 1 Cecidomyidous gall described by Osten Sacken and 1 n. sp., besides 2 Acaridous galls n. sp. And lastly Negundo bears 1 Acaridous gall n. sp. The sum total of Cecidomyidous galls is 56 in the first list on eight genera of plants and 16 in the second list on nine genera of plants, including two galls of doubtful origin; total 72 galls, occurring on seventeen different genera of woody plants. The sum total of Acaridous galls, excluding some mere deformations, is 7 in the first list on four genera of plants, inclusive of one gall of doubtful origin, and 13 in the second list occurring on ten genera of plants; total 20 galls, occurring on fourteen different genera of woody plants. Grand total 92 galls, occurring on twenty-five different genera of woody plants, six out of the twenty-five bearing both kinds of galls.

Now look at these statistics, to see if they will teach us anything. On the one hand we have 14 genera of woody plants producing fully 96 galls other than Acaridous and Cecidomyidous galls; and on the other hand we have no less than 33 genera of the same group of plants, which on the most diligent search I have not found to produce any such galls; and which, so far as I am aware, have not been recorded by North American authors as producing them. Why should this be so? Why should 96 galls be distributed so unequally among 47 genera of the same group of plants, that 33 out of the 47, or more than two-thirds of the whole number, have none at all, and a single genus, Quercus, monopolizes more than one-half of the whole number? We cannot say that all these 33 genera are naturally incapable of producing galls; for at least 15 of the 33, and probably more, produce either Acaridous or Cecidomyidous galls or both. Why, then, do they not produce other galls as well? Why, as a general rule, is each gall-making genus of true insects, with the exception of *Cecidomyia* and its subgenera, restricted to a single genus of plants? Why do so many species of the same genus often occur on the same genus of plants—58 N. A. species of *Cynips*, for example, on the single genus Quercus, besides many undescribed N. A. species, and besides the 100 species of *Cynips* that infest the genus Quercus in Europe? On the Creative Theory, all this is an inexplicable mystery. On the Derivative Theory, we see at once why it should be so. For if our modern species were genetically derived from pre-existing species, several new species being generated from one old one, and whole groups from time to time becoming extinct, the actual state of facts, as it has been presented above, is pre-

cisely that which we should, reasoning *a priori*, expect to meet with. Surely, therefore, upon general principles, a hypothesis, which accounts clearly and satisfactorily for a great mass of phenomena, is more likely to be a correct one, than a hypothesis which accounts for nothing, and, while it mercifully spares our Reasoning powers, draws most largely and exorbitantly upon our Faith.

And now, in conclusion, it is but fair dealing towards the American reader, as in the former part of this Paper I expressed considerable skepticism in regard to Wagner's supposed discovery of viviparous larvæ, (pp. 571—4 and 641—4,) to take this opportunity of stating, that I am informed by Baron Osten Sacken that Wagner's facts have been verified by the German entomologist Gerstaecker and that they are generally believed in Germany; and that Mr. Darwin writes me word that they are believed by the distinguished English naturalist, Sir J. Lubbock. It further appears, from what Baron Osten Sacken tells me, that the prolific Cecidomyidous larvæ, instead of belonging to the genus *Cecidomyia*, as I had been originally led to suppose, (*Proc.* &c. III, pp. 571—2,) are now ascertained to belong in reality to a rather anomalous genus, which has been named *Miastor*, and which "has been found to be almost identical with *Heteropeza* Winnertz." Respecting this last genus Loew observes, that "it seems to harmonize in many points with the genera of the first section, [which includes *Cecidomyia*,] but differs very strikingly by the totally different structure of its tarsi." (*Dipt. N. A.* p. 7.) Hence the principal stumbling-block which lay in my path—namely, that different species, belonging to one and the same genus *Cecidomyia*, should have such essentially different and heterogeneous habits—is removed at once; and I beg leave hereby to recant and disavow my former skepticism as to Wagner's very remarkable and important discovery.

Rock Island, Ill., August 31, 1866.

ERRATA.

Page 237, line 4 from bottom, for "*Pristophora*" read "*Pristiphora.*"
Page 268, lines 24—5, for "scutlelatus" read "scutellatus."